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United States  
Department of  
Agriculture

# Washington

## Water Supply Outlook Report

### June 1, 2003





# Water Supply Outlook Reports and Federal - State - Private Cooperative Snow Surveys

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## *How forecasts are made*

Most of the annual streamflow in the western United States originates as snowfall that has accumulated in the mountains during the winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Measurements of snow water equivalent at selected manual snow courses and automated SNOTEL sites, along with precipitation, antecedent streamflow, and indices of the El Niño / Southern Oscillation are used in computerized statistical and simulation models to prepare runoff forecasts. These forecasts are coordinated between hydrologists in the Natural Resources Conservation Service and the National Weather Service. Unless otherwise specified, all forecasts are for flows that would occur naturally without any upstream influences.

Forecasts of any kind, of course, are not perfect. Streamflow forecast uncertainty arises from three primary sources: (1) uncertain knowledge of future weather conditions, (2) uncertainty in the forecasting procedure, and (3) errors in the data. The forecast, therefore, must be interpreted not as a single value but rather as a range of values with specific probabilities of occurrence. The middle of the range is expressed by the 50% exceedance probability forecast, for which there is a 50% chance that the actual flow will be above, and a 50% chance that the actual flow will be below, this value. To describe the expected range around this 50% value, four other forecasts are provided, two smaller values (90% and 70% exceedance probability) and two larger values (30%, and 10% exceedance probability). For example, there is a 90% chance that the actual flow will be more than the 90% exceedance probability forecast. The others can be interpreted similarly.

The wider the spread among these values, the more uncertain the forecast. As the season progresses, forecasts become more accurate, primarily because a greater portion of the future weather conditions become known; this is reflected by a narrowing of the range around the 50% exceedance probability forecast. Users should take this uncertainty into consideration when making operational decisions by selecting forecasts corresponding to the level of risk they are willing to assume about the amount of water to be expected. If users anticipate receiving a lesser supply of water, or if they wish to increase their chances of having an adequate supply of water for their operations, they may want to base their decisions on the 90% or 70% exceedance probability forecasts, or something in between. On the other hand, if users are concerned about receiving too much water (for example, threat of flooding), they may want to base their decisions on the 30% or 10% exceedance probability forecasts, or something in between. Regardless of the forecast value users choose for operations, they should be prepared to deal with either more or less water. (Users should remember that even if the 90% exceedance probability forecast is used, there is still a 10% chance of receiving less than this amount.) By using the exceedance probability information, users can easily determine the chances of receiving more or less water.

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# Washington Water Supply Outlook

June 2003

## General Outlook

The month of May progressed with near normal melt-out of mountain snowpack. 43% of the 58 Washington SNOTEL sites reported some snow remaining on June 1<sup>st</sup>. However with above average temperatures the first week of the month, most sites are losing 1-2 inches of snow-water-content and up to 5 inches of snow depth per day. An aerial survey conducted early in the month indicated that the current snow line is at an approximate elevation of 4500 feet and rising fast. According to the National Weather Service "warm episode (El Nino) conditions rapidly dissipated in the tropical pacific during March and April, 2003". However based on current conditions and recent observed trends it appears that cold episode (La Nina) conditions will develop in the tropical pacific during the next several months. Therefore, long term skill in forecasting is diminished during an ENSO transition.

## Snowpack

The June 1 statewide SNOTEL readings remain below average at 74%. Out of the basins that have snowpack remaining, the Skykomish River Basin reported the lowest readings at 40% of average. SNOTEL sites in the White River Basin reported the highest at 120% of average. Westside averages from SNOTEL, and June 1 snow surveys, included the North Puget Sound river basins with 84% of average, the Central Puget river basins with 44%, and the Lewis-Cowlitz basins with 70% of average. Snowpack along the east slopes of the Cascade Mountains included the Yakima area with 74% and the Wenatchee area with 79%. Snowpack in the Spokane River Basin was at 48% and the Pend Oreille River Basin had 92% of average. Readers should be cautious of using percent of normal as a true indicator of current conditions. The most important factor is the calculation of snow water content as contributing to runoff.

BASIN	PERCENT OF LAST YEAR	PERCENT OF AVERAGE
Spokane .....	42 .....	58
Newman Lake .....	39 .....	47
Pend Oreille .....	81 .....	89
Okanogan .....	67 .....	72
Methow .....	70 .....	76
Similkameen .....	41 .....	53
Wenatchee .....	62 .....	72
Chelan .....	65 .....	83
Upper Yakima .....	45 .....	63
Lower Yakima .....	76 .....	83
Ahtanum Creek .....	88 .....	91
Walla Walla .....	64 .....	79
Lower Snake .....	86 .....	91
Cowlitz .....	66 .....	81
Lewis .....	43 .....	72
White .....	82 .....	89
Green .....	36 .....	58
Cedar .....	23 .....	57
Snoqualmie .....	37 .....	64
Skykomish .....	42 .....	67
Skagit .....	58 .....	75
Baker .....	72 .....	87
Nooksack .....	47 .....	48
Olympic Peninsula .....	63 .....	75



## Precipitation

During the month of May, the National Weather Service and Natural Resources Conservation Service climate stations reported near to much below average precipitation totals throughout most of Washington river basins. The highest percent of average in the state was at Mt Adams Ranger Station, which reported 173% of average for a total of 2.6 inches. The average for this site is 1.5 inches for May. The wettest spot in the state was reported at June Lake SNOTEL with a May accumulation of 4.5 inches, only 54% of the 30-year average for the site. Averages for the water-year held steady in most basins, regardless of below average rain fall. The Lower Snake River Basin reported the highest water-year average at 102%. The Upper Yakima River Basin reported the lowest at 83% of average and remained the same as last month with only 76% of average May accumulations.

RIVER BASIN	MAY PERCENT OF AVERAGE	WATER YEAR PERCENT OF AVERAGE
Spokane .....	86 .....	91
Colville-Pend Oreille .....	82 .....	94
Okanogan-Methow .....	42 .....	94
Wenatchee-Chelan .....	47 .....	88
Upper Yakima .....	76 .....	83
Lower Yakima .....	74 .....	96
Walla Walla .....	84 .....	100
Lower Snake .....	99 .....	102
Cowlitz-Lewis .....	58 .....	91
White-Green-Puyallup .....	65 .....	84
Central Puget Sound .....	65 .....	84
North Puget Sound .....	60 .....	85
Olympic Peninsula .....	60 .....	93

## Reservoir

Seasonal reservoir levels in Washington vary greatly due to specific watershed management practices required in preparation for irrigation season, fisheries management, power generation and flood control. Reservoir storage in the Yakima Basin was 733,700-acre feet, 101% of average for the Upper Reaches and 232,400-acre feet, 114% of average for Rimrock and Bumping lakes. Storage at the Okanogan reservoirs was 60% of average for June 1. The power generation reservoirs included the following: Coeur d'Alene Lake, 216,500 acre feet, 80% of average and 91% of capacity; Chelan Lake 452,600-acre feet, 96% of average and 67% of capacity; and Ross Lake on the Skagit River at 115% of average and 85% of capacity.

BASIN	PERCENT OF CAPACITY	CURRENT STORAGE AS PERCENT OF AVERAGE
Spokane .....	91 .....	80
Colville-Pend Oreille .....	74 .....	123
Okanogan-Methow .....	54 .....	60
Wenatchee-Chelan .....	67 .....	96
Upper Yakima .....	88 .....	101
Lower Yakima .....	100 .....	114
North Puget Sound .....	85 .....	115

*For more information contact your local Natural Resources Conservation Service office.*

## Streamflow

June forecasts vary from 116% of average for Icicle Creek near Leavenworth to 66% of average for Mill Creek at Walla Walla. June-September forecasts for some Western Washington streams include the Cedar River near Cedar Falls, 88%; Green River, 86%; and Skagit River, 87%. Some Eastern Washington streams include the Yakima River near Parker, 98%; Wenatchee River at Plain, 94%; and Spokane River near Post Falls, 75%. Volumetric forecasts are developed using current, historic and average snowpack, precipitation and streamflow data collected and coordinated by organizations cooperating with NRCS.

Statewide May streamflows varied considerably depending on local climate and reservoir operations. The Snake River below Ice Harbor Dam had the highest reported flows with 99% of average. The Okanogan River at Tonasket with 53% of average was the lowest in the state. Other streamflows were the following percentage of average: the Cowlitz, 72%; the Spokane at Spokane, 54%; the Columbia below Rock Island Dam, 77%; and the Cle Elum near Roslyn, 77%.

BASIN	PERCENT OF AVERAGE MOST PROBABLE FORECAST (50 PERCENT CHANCE OF EXCEEDENCE)
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Spokane .....	75-80
Colville-Pend Oreille .....	75-100
Okanogan-Methow .....	69-110
Wenatchee-Chelan .....	68-116
Upper Yakima .....	68-105
Lower Yakima .....	83-113
Walla Walla .....	66-84
Lower Snake .....	82-113
Cowlitz-Lewis .....	76-85
White-Green-Puyallup .....	86-88
Central Puget Sound .....	88-94
North Puget Sound .....	85-90
Olympic Peninsula .....	87

STREAM	PERCENT OF AVERAGE MAY STREAMFLOWS
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Pend Oreille Below Box Canyon .....	78
Kettle at Laurier .....	77
Columbia at Birchbank .....	79
Spokane at Long Lake .....	56
Similkameen at Nighthawk .....	57
Okanogan at Tonasket .....	53
Methow at Pateros .....	65
Chelan at Chelan .....	81
Wenatchee at Pashastin .....	79
Yakima at Cle Elum .....	72
Yakima at Parker .....	79
Naches at Naches .....	84
Grande Ronde at Troy .....	83
Snake below Lower Granite Dam .....	83
SF Walla Walla near Milton Freewater .....	93
Columbia River at The Dalles .....	77
Lewis at Ariel .....	72
Cowlitz below Mayfield Dam .....	71
Skagit at Concrete .....	73

*For more information contact your local Natural Resources Conservation Service office.*



# BASIN SUMMARY OF SNOW COURSE DATA

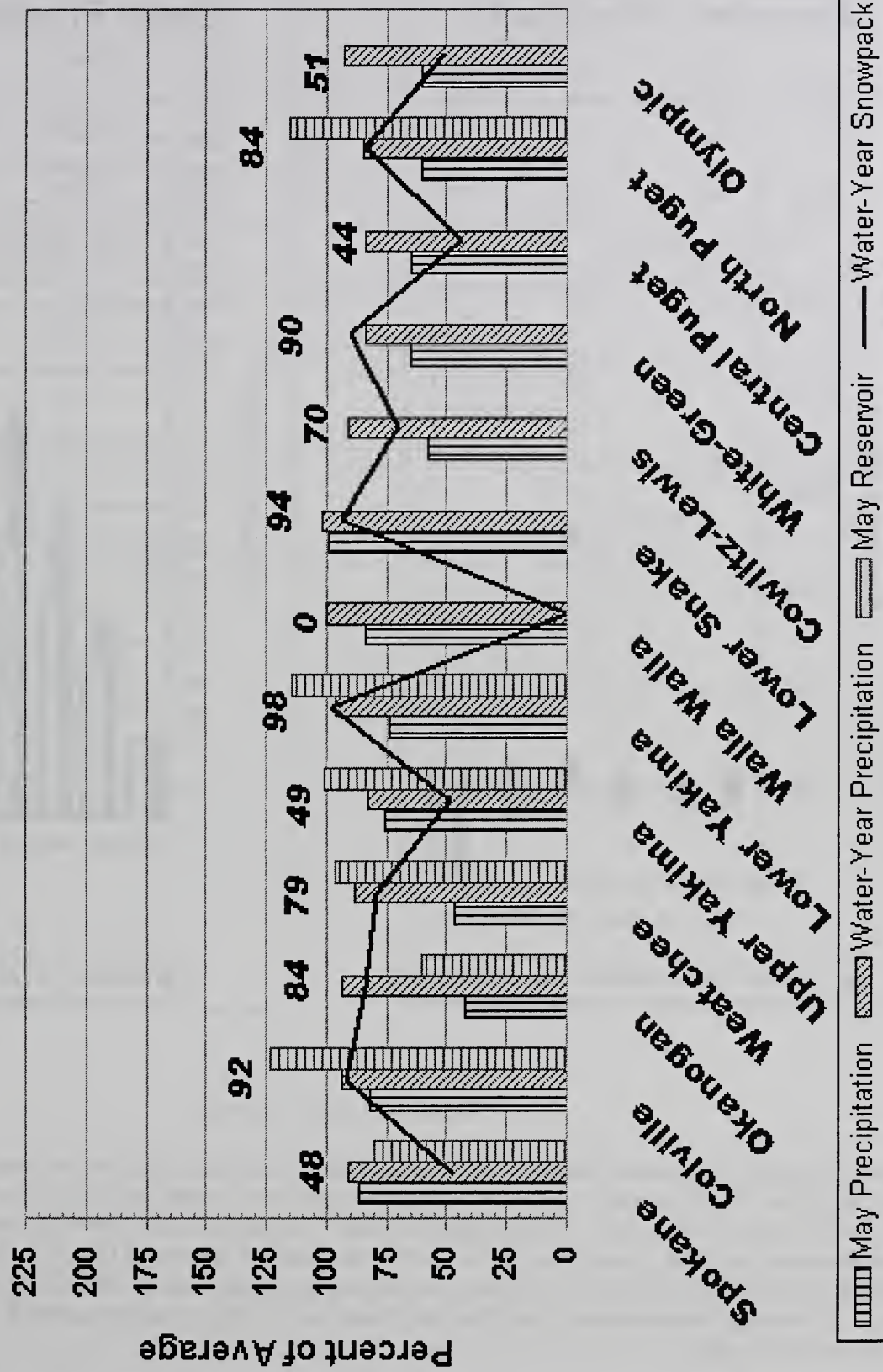
JUNE 2003

SNOW COURSE	ELEVATION	DATE	SNOW DEPTH	WATER CONTENT	LAST YEAR	AVERAGE 1971-00	SNOW COURSE	ELEVATION	DATE	SNOW DEPTH	WATER CONTENT	LAST YEAR	AVERAGE 1971-00
ABERDEEN LAKE CAN.	4000	6/01/03	---	.0E	--	--	MOSES MTN SNOTEL	4800	6/01/03	---	.0	.0	.1
ALPINE MEADOWS	3500	6/01/03	---	11.0E	37.0	--	MOSQUITO RDG SNOTEL	5200	6/01/03	---	4.3	21.2	11.0
ALPINE MEADOWS SNTL	3500	6/01/03	---	12.8	--	31.4	MOUNT BLUM AM	5800	6/01/03	---	52.0E	90.0	--
BADGER PASS SNOTEL	6900	6/01/03	32	16.6	37.8	22.9	MOUNT CRAG SNOTEL	4050	6/01/03	8	4.0	19.9	7.8
BARKER LAKES SNOTEL	8250	6/01/03	30	11.5	7.2	9.5	MT. KOBAU CAN.	5500	5/30/03	10	5.0	9.0	5.2
BASIN CREEK SNOTEL	7180	6/01/03	---	.0	.0	4.1	MOUNT GARDNER SNOTEL	2860	6/01/03	0	.0	.0	.0
BEAVER CREEK TRAIL	2200	5/29/03	0	.0	.0	--	N.F. ELK CR SNOTEL	6250	6/01/03	0	.0	.0	.6
BEAVER PASS	3680	5/29/03	10	5.5	22.8	--	NEW HOZOMEEN LAKE	2800	5/29/03	0	.0	.0	--
BIG WHITE MTN CAN.	5510	6/03/03	11	4.9	10.6	8.0	NEZ PERCE CMP SNOTEL	5650	6/01/03	---	.0	.0	.3
BLACK PINE SNOTEL	7100	6/01/03	0	.0	.0	1.9	NOISY BASIN SNOTEL	6040	6/01/03	46	22.9	33.6	30.1
BLEWETT PASS#2SNOTEL	4270	6/01/03	0	.0	.0	.0	NORTH FORK JOCKO	6330	6/01/03	37	18.1	37.7	--
BRENDA MINE CAN.	4450	6/01/03	---	.0	--	2.7	OLALLIE MDWS SNOTEL	3960	6/01/03	---	18.9	55.5	31.8
BROWN TOP AM	6000	5/29/03	88	44.2	73.6	--	OLALLIE MEADOWS	3630	6/01/03	---	6.0E	--	--
BUMPING RIDGE SNOTEL	4600	6/01/03	---	4.6	10.6	11.6	OPHIR PARK	7150	5/26/03	19	8.4	.9	--
BUNCHGRASS MDWS SNOTEL	5000	6/01/03	---	14.4	14.5	9.7	PARADISE PARK SNOTEL	5500	6/01/03	---	51.6	84.6	61.6
CAVUSE PASS	5300	6/01/03	---	60.5E	--	--	PARK CK RIDGE SNOTEL	4600	6/01/03	9	3.9	30.8	11.5
CHECKEN CREEK	4060	5/30/03	0	.0	.0	.0	PETERSON MDW SNOTEL	7200	6/01/03	---	6.8	1.1	2.7
COMBINATION SNOTEL	5600	6/01/03	---	.0	.0	.0	PIGTAIL PEAK SNOTEL	5900	6/01/03	84	42.0	45.0	39.9
COPPER BOTTOM SNOTEL	5200	6/01/03	0	.0	.0	.0	PIKE CREEK SNOTEL	5930	6/01/03	0	.0	15.6	7.3
CORRAL PASS SNOTEL	6000	6/01/03	---	25.2	36.5	23.1	POPE RIDGE SNOTEL	3540	6/01/03	0	.0	.0	.0
COUGAR MTN. SNOTEL	3200	6/01/03	0	.0	11.3	1.5	POTATO HILL SNOTEL	4500	6/01/03	---	.6	7.9	2.7
DALY CREEK SNOTEL	5780	6/01/03	0	.0	.0	.0	QUARTZ PEAK SNOTEL	4700	6/01/03	---	.0	.0	.0
DEVILS PARK	5900	5/30/03	58	30.0	56.4	--	RAINY PASS SNOTEL	4780	6/01/03	---	19.6	35.5	24.3
DISCOVERY BASIN	7050	5/28/03	18	8.2	1.0	2.4	REX RIVER SNOTEL	1900	6/01/03	0	.0	22.3	6.1
DOCK BUTTE AM	3800	6/01/03	---	35.0E	67.0	--	ROCKER PEAK SNOTEL	8000	6/01/03	26	11.4	10.2	11.7
EASY PASS AM	5200	6/01/03	---	60.0E	95.0	--	SADDLE MTN SNOTEL	7900	6/01/03	43	15.9	15.8	16.3
ELBOW LAKE SNOTEL	3200	6/01/03	0	.0	23.9	19.8	SALMON MDWS SNOTEL	4500	6/01/03	0	.0	.0	.0
EMERY CREEK SNOTEL	4350	6/01/03	---	.0	.0	.0	SASSE RIDGE SNOTEL	4200	6/01/03	0	.0	18.9	5.9
ENDERBY CAN.	5800	5/31/03	72	35.0	47.6	37.8	SAVAGE PASS SNOTEL	6170	6/01/03	30	13.1	17.6	10.4
ESPERON CK. UP CAN.	5050	6/01/03	0	.0	--	3.6	SAWMILL RIDGE	4700	5/30/03	0	.0	25.0	--
FISH LAKE SNOTEL	3370	6/01/03	0	.0	7.6	7.5	SCHREIBERS MDW AM	3400	6/01/03	---	33.0E	58.0	--
FLATTOP MTN SNOTEL	6300	6/01/03	70	33.6	49.1	36.5	SHEEP CANYON SNOTEL	4050	6/01/03	---	.0	28.7	13.7
FREEZEOUT CK. TRAIL	3500	5/29/03	0	.0	.0	--	SHERWIN SNOTEL	3200	6/01/03	---	.0	.0	.0
FROHNER MDWS SNOTEL	6480	6/01/03	0	.0	.0	.7	SILVER STAR MTN CAN.	5600	5/28/03	44	20.8	33.3	18.4
GRASS MOUNTAIN #2	2900	5/30/03	0	.0	.0	--	SKALKAKO SNOTEL	7260	6/01/03	38	17.9	13.8	14.6
GRAVE CRK SNOTEL	4300	6/01/03	---	.0	.0	.0	SKOOKUM CREEK SNOTEL	3920	6/01/03	---	.0	28.7	1.5
GREEN LAKE	6000	6/01/03	---	16.0E	--	--	SOURDOUGH GULCH SNTL	4000	6/01/03	0	.0	.0	--
GREEN LAKE SNOTEL	6000	6/01/03	17	6.3	6.4	6.6	SPENCER MDW SNOTEL	3400	6/01/03	---	.0	12.8	3.0
GROUSE CAMP SNOTEL	5380	6/01/03	0	.0	.0	.2	SPIRIT LAKE SNOTEL	3100	6/01/03	---	.0	.0	--
HAND CREEK SNOTEL	5030	6/01/03	0	.0	.0	.0	SOURDOUGH GULCH SNTL	4000	6/01/03	0	.0	.0	--
HARTS PASS SNOTEL	6500	6/01/03	54	27.0E	39.1	29.2	STAHL PEAK SNOTEL	6030	6/01/03	---	28.7	43.5	28.0
HELL ROARING DIVIDE	5770	5/27/03	31	14.1	18.9	10.8	STAMPEDE PASS SNOTEL	3860	6/01/03	---	12.2	41.2	18.6
HERRIG JUNCTION	4850	5/30/03	19	6.8	19.1	5.4	STEVENS PASS SNOTEL	4070	6/01/03	5	3.3	24.2	9.0
HIGH RIDGE SNOTEL	4980	6/01/03	---	.0	.0	1.2	STEVENS PASS SAND SD	3700	6/01/03	---	.0E	--	--
HOODOO BASIN SNOTEL	6050	6/01/03	57	28.0	51.2	28.4	STRYKER BASIN	6180	5/30/03	45	21.8	33.8	19.4
HUMBOLDT GLCH SNOTEL	4250	6/01/03	---	.0	.9	.0	SUNSET SNOTEL	5540	6/01/03	---	.0	14.8	13.5
JUNE LAKE SNOTEL	3200	6/01/03	---	.0	32.3	10.1	SURPRISE LKS SNOTEL	4250	6/01/03	---	19.4	37.3	19.0
KRAFT CREEK SNOTEL	4750	6/01/03	---	.0	.0	.0	THUNDER BASIN	4200	6/01/03	---	9.0E	22.6	--
LESTER CREEK	3100	5/30/03	0	.0	15.6	--	TINKHAM CREEK SNOTEL	3000	6/01/03	---	.0	18.3	2.9
LOLO PASS SNOTEL	5240	6/01/03	11	2.9	13.1	4.9	TOUCHET SNOTEL	5530	6/01/03	0	.0	5.8	2.5
LONE PINE SNOTEL	3800	6/01/03	---	13.5	41.8	18.4	TROUGH #2 SNOTEL	5310	6/01/03	---	.0	.0	.0
LOOKOUT SNOTEL	5140	6/01/03	0	.0	27.7	8.0	TV MOUNTAIN	6800	6/01/03	0	.0	8.2	--
LOST HORSE SNOTEL	5000	6/01/03	0	.0	.0	.2	TWELVEMILE SNOTEL	5600	6/01/03	0	.0	.0	.4
LOST LAKE SNOTEL	6110	6/01/03	---	31.0	65.7	41.5	TWIN LAKES	2700	5/30/03	0	.0	--	--
LUBRECHT SNOTEL	4680	6/01/03	0	.0	.0	.0	TWIN LAKES SNOTEL	6400	6/01/03	41	23.3	30.6	22.3
LYMAN LAKE SNOTEL	5900	6/01/03	---	49.1	76.9	50.8	UPPER WHEELER SNOTEL	4400	6/01/03	0	.0	.0	.0
LYNN LAKE	4000	5/30/03	0	.0	24.0	--	WARM SPRINGS SNOTEL	7800	6/01/03	---	22.5	16.9	17.0
MEADOWS CABIN	1900	5/30/03	0	.0	.0	--	WATSON LAKES AM	4500	6/01/03	---	55.0E	75.0	--
MEADOWS PASS SNOTEL	3240	6/01/03	---	.0	12.3	.9	WELLS CREEK SNOTEL	4200	6/01/03	1	4.1	18.9	--
MICA CREEK SNOTEL	4750	6/01/03	0	.0	9.1	.0	WHITE PASS ES SNOTEL	4500	6/01/03	0	.0	8.2	5.6
MORRISSEY RIDGE CAN.	6100	6/01/03	---	9.6	--	--	WHITE ROCKS MTN CAN.	7200	5/30/03	0	.0	15.4	7.4
MORSE LAKE SNOTEL	5400	6/01/03	---	43.0	33.4	33.6							

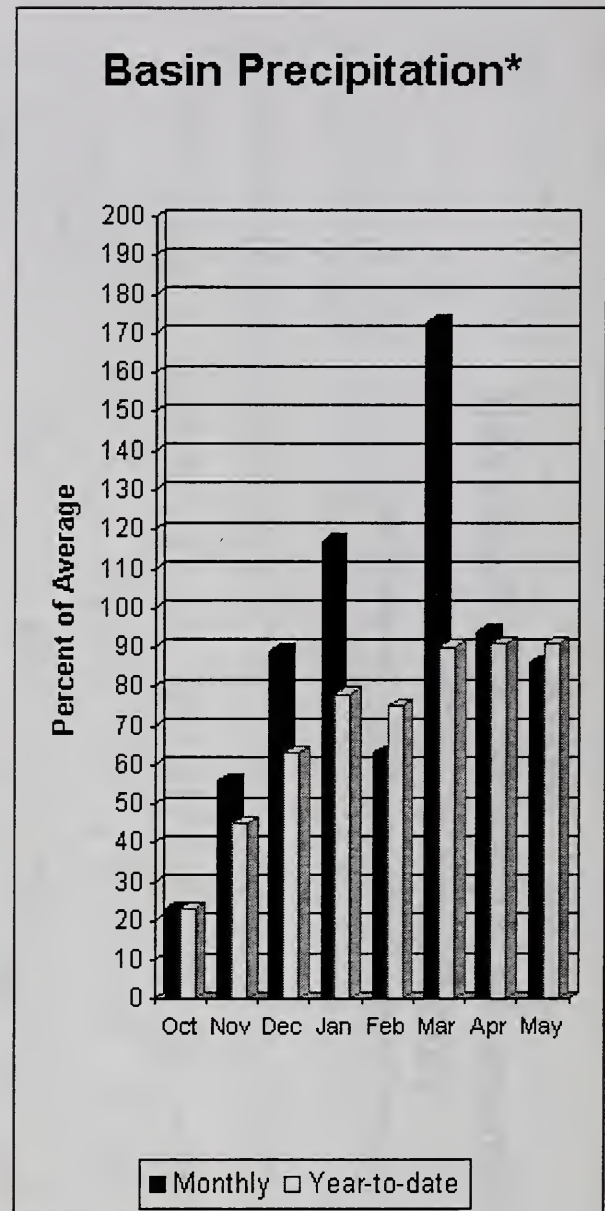
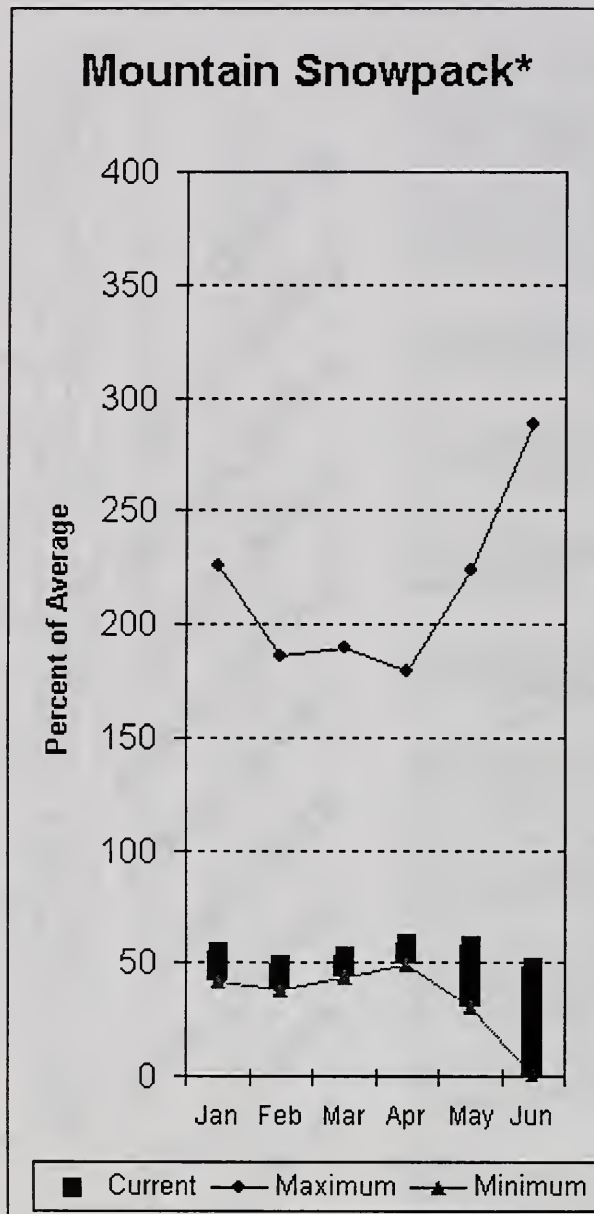


# May 1, 2003 - Snowpack, Precipitation and Reservoir Conditions at a Glance

(Water Year = October 1, 2002 - Current Date)



# Spokane River Basin



\*Based on selected stations

The June 1 forecasts for summer runoff within the Spokane River Basin are 75% of average near Post Falls and 80% at Long Lake. The forecast is based on a basin snowpack that is 48% of average and precipitation that is 91% of average for the water year. Precipitation for May was near normal at 86% of average. Streamflow on the Spokane River at Long Lake, was 56% of average for May. June 1 storage in Coeur d'Alene Lake, was 216,500-acre feet, 80% of average and 91% of capacity. Snowpack at Quartz Peak SNOTEL site melted May 15<sup>th</sup>, two weeks early. Average temperatures in the Spokane basin were 1 degree below normal for May and 1 degree above for the water year.

*For more information contact your local Natural Resources Conservation Service office.*



# Spokane River Basin

## SPOKANE RIVER BASIN Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<<===== Drier ===== Future Conditions ===== Wetter =====>>		Chance Of Exceeding *				30-Yr Avg. (1000AF)
		90%	70%	50% (Most Probable)		30%	10%	
		(1000AF)	(1000AF)	(1000AF)	(% AVG.)	(1000AF)	(1000AF)	
SPOKANE near Post Falls (2)	JUN-SEP	365	495	580	75	665	795	773
	JUN-JUL	295	415	500	74	585	705	676
SPOKANE at Long Lake (2)	JUN-JUL	425	560	650	77	740	875	840
	JUN-SEP	605	750	845	80	940	1085	1061

SPOKANE RIVER BASIN Reservoir Storage (1000 AF) - End of May					SPOKANE RIVER BASIN Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
COEUR D'ALENE	238.5	216.5	437.0	270.4	SPOKANE RIVER	8	25	48
					NEWMAN LAKE	1	0	0

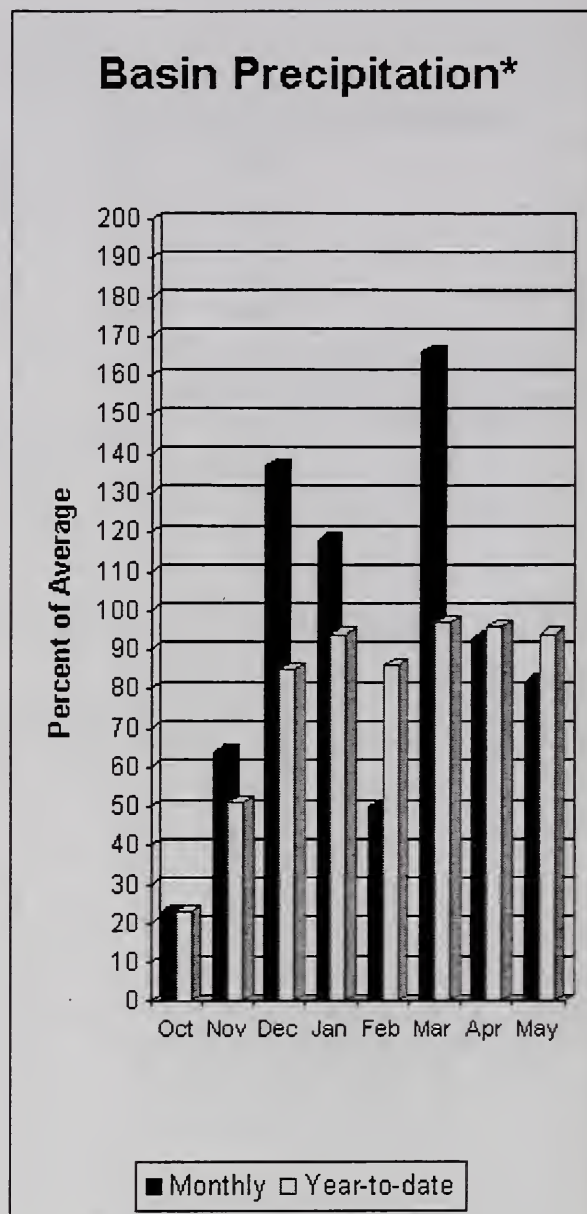
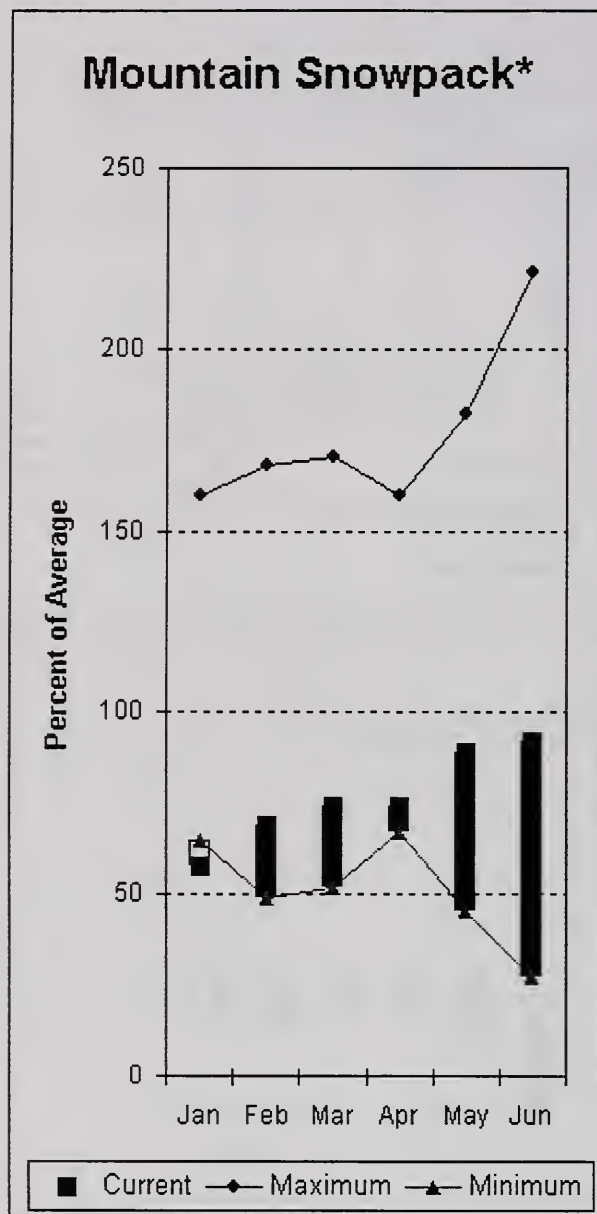
\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

(1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.

(2) - The value is natural volume - actual volume may be affected by upstream water management.

## Colville - Pend Oreille River Basins



\*Based on selected stations

The June – September average forecast for the Kettle River streamflow is 89%, Colville at Kettle Falls is 75%, and Priest River near the Town of Priest River is 78%. May streamflow was 78% of average on the Pend Oreille River, 79% on the Columbia at Birchbank and 77% on the Kettle River. June 1 snow cover was 84% of average in the Pend Oreille Basin River Basin. Bunchgrass Meadows SNOTEL site had 14.4 inches of snow water on the snow pillow. Normally Bunchgrass would have 9.7 inches on June 1. Precipitation during May was 111% of average, bringing the year-to-date precipitation to 94% of average. Reservoir storage in Roosevelt Lake was reported to be 123% of average and 74% of capacity on June 1. Average temperatures were 1-2 degrees below normal for May and 1 degree above for the water year.

For more information contact your local Natural Resources Conservation Service office.



# Colville - Pend Oreille River Basins

## Streamflow Forecasts - June 1, 2003

		<<===== Drier ===== Future Conditions ===== Wetter =====>>						
Forecast Point	Forecast Period	=====		Chance Of Exceeding *		=====		30-Yr Avg. (1000AF)
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
PEND OREILLE Lake Inflow (2)	JUN-JUL	3820	4570	5080	83	5590	6340	6120
	JUN-SEP	4760	5590	6150	84	6710	7540	7290
PRIEST near Priest River (1,2)	JUN-JUL	142	195	220	76	245	300	291
	JUN-SEP	180	240	270	78	300	360	345
PEND OREILLE bl Box Canyon (2)	JUN-JUL	3540	4500	5150	83	5800	6760	6190
	JUN-SEP	4620	5580	6230	85	6880	7840	7370
CHAMOKANE CREEK near Long Lake	JUL-AUG	3.10	3.40	3.50	100	3.60	3.90	3.51
COLVILLE at Kettle Falls	JUN-SEP	18.8	29	36	75	43	53	48
	JUN-JUL	12.3	21	27	77	33	42	35
KETTLE near Laurier	JUN-SEP	585	705	785	89	865	985	880
	JUN-JUL	590	685	750	96	815	910	782
COLUMBIA at Birchbank (1,2)	JUN-JUL	16979	19125	20100	88	21075	23220	22910
	JUN-SEP	23824	26558	27800	88	29040	31780	31580
COLUMBIA at Grand Coulee Dm (1,2)	JUN-SEP	30425	34259	36000	86	37740	41570	41706
	JUN-JUL	22525	25671	27100	86	28530	31680	31400

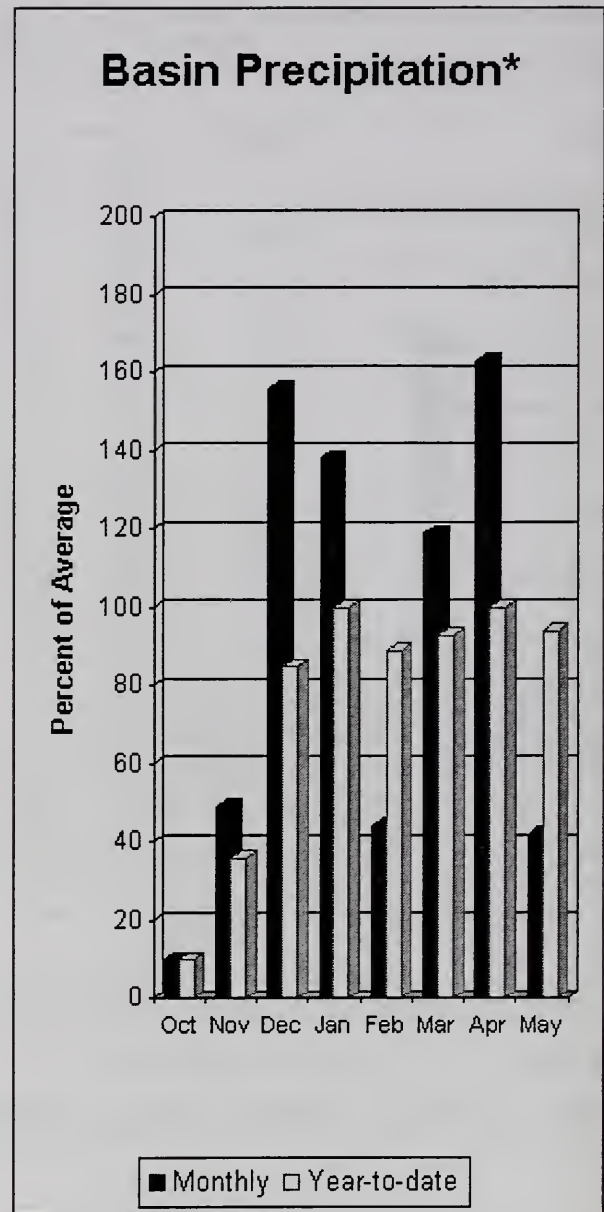
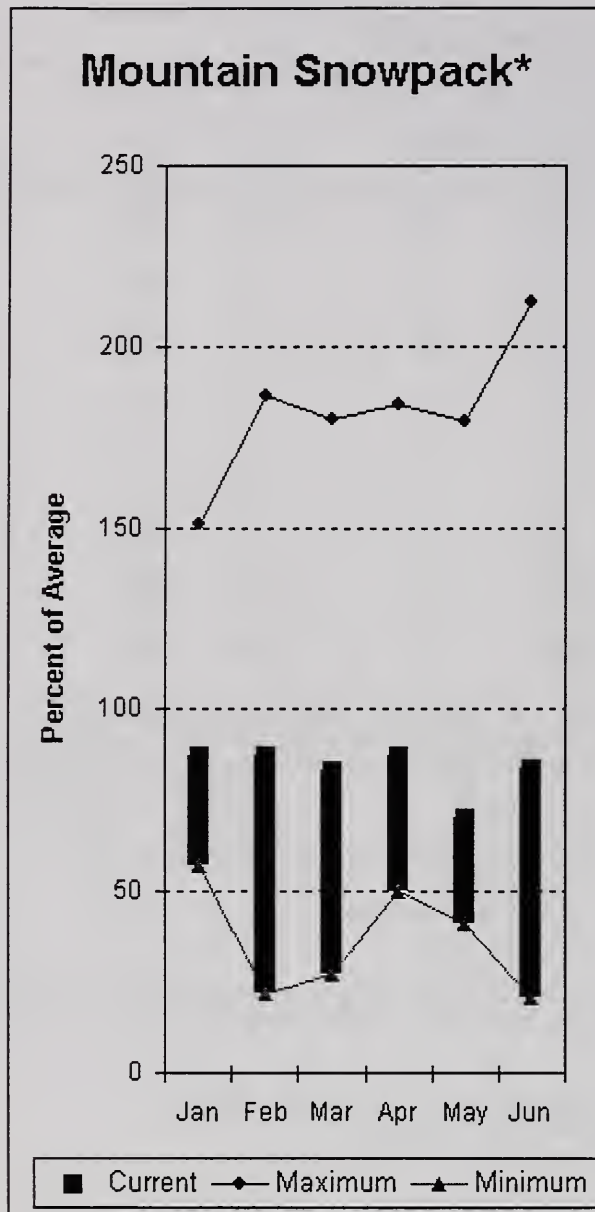
COLVILLE - PEND OREILLE RIVER BASINS Reservoir Storage (1000 AF) - End of May					COLVILLE - PEND OREILLE RIVER BASINS Watershed Snowpack Analysis - June 1, 2003		
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of Last Yr Average
		This Year	Last Year	Avg			
ROOSEVELT	5232.0	3758.4	2963.7	2973.0	COLVILLE RIVER	0	0
BANKS	715.0	659.9	682.1	605.7	PEND OREILLE RIVER	8	32
					KETTLE RIVER	1	46

\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

- (1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.  
 (2) - The value is natural volume - actual volume may be affected by upstream water management.

## Okanogan - Methow River Basins



\*Based on selected stations

Summer runoff average forecast for the Okanogan River is 69%, Similkameen River is 74%, Methow River is 85%, Salmon Creek is 78% and Beaver Creek is 110%. June 1 snow cover on the Okanogan was 84% of average and Methow was 87%. May precipitation in the Okanogan-Methow was 42% of average, with precipitation for the water year at 94% of average. May streamflow for the Methow River was 65% of average, 53% for the Okanogan River and 57% for the Similkameen. Snow-water content at Salmon Meadows SNOTEL melted out close to May 1<sup>st</sup>. Combined storage in the Conconully Reservoirs was 12,700-acre feet, which is 54% of capacity and 60% of the June 1 average. Temperatures were 2 degrees below normal for the past month and 2 degrees above normal for the water year.

*For more information contact your local Natural Resources Conservation Service office.*



# Okanogan - Methow River Basins

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<<===== Drier ===== Future Conditions ===== Wetter =====>>						30-Yr Avg. (1000AF)
		Chance Of Exceeding *						
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
SIMILKAMEEN near Nighthawk (1)	JUN-JUL	300	470	550	75	630	800	734
	JUN-SEP	365	540	620	74	700	875	835
OKANOGAN near Tonasket (1)	JUN-JUL	296	512	610	71	708	924	861
	JUN-SEP	363	608	720	69	833	1078	1048
SALMON CREEK near Conconully	JUN-JUL	1.81	4.96	7.10	76	9.90	14.10	9.30
	JUN-SEP	2.0	5.5	7.9	78	11.0	15.6	10.2
BEAVER CREEK below SF near Twisp	JUN-SEP	3.90	5.70	6.90	110	8.10	9.90	6.30
	JUN-JUL	3.00	4.70	5.90	111	7.10	8.80	5.30
METHOW RIVER near Pateros	JUN-SEP	355	425	475	85	525	595	562
	JUN-JUL	310	370	410	84	450	510	488

OKANOGAN - METHOW RIVER BASINS Reservoir Storage (1000 AF) - End of May					OKANOGAN - METHOW RIVER BASINS Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage *** This Year	Last Year	Avg	Watershed	Number of Data Sites	This Year as % of Last Yr	% of Average
SALMON LAKE	10.5	4.5	4.2	9.7	OKANOGAN RIVER	7	61	86
CONCONULLY RESERVOIR	13.0	8.2	5.4	11.4	OMAK CREEK	1	0	0
					SANPOIL RIVER	0	0	0
					SIMILKAMEEN RIVER	0	0	0
					TOATS COULEE CREEK	0	0	0
					CONCONULLY LAKE	1	0	0
					METHOW RIVER	3	62	87

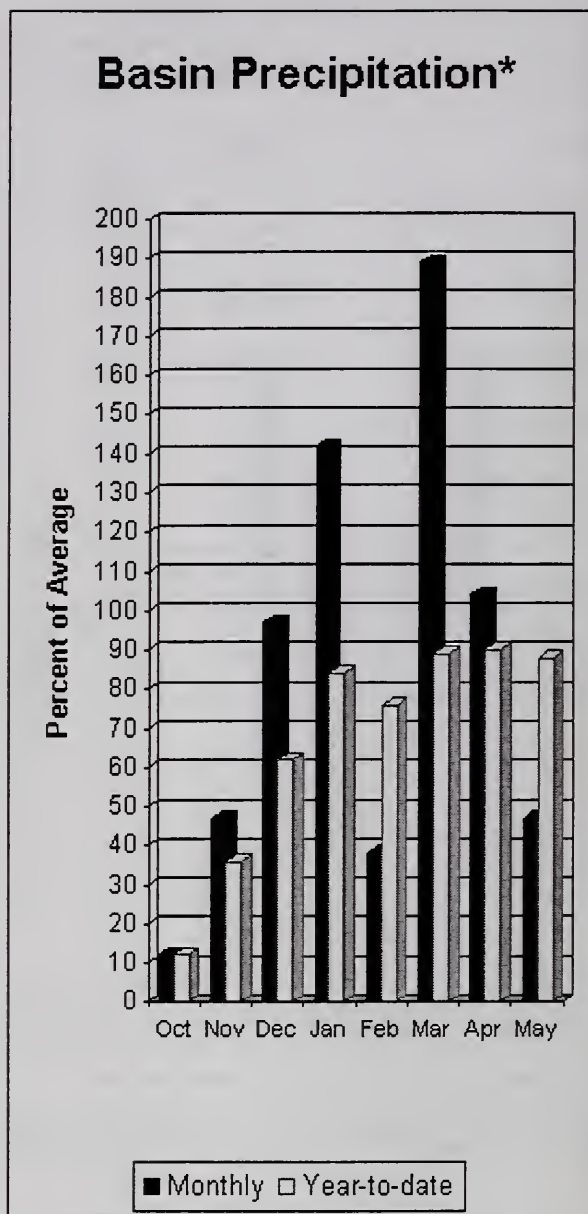
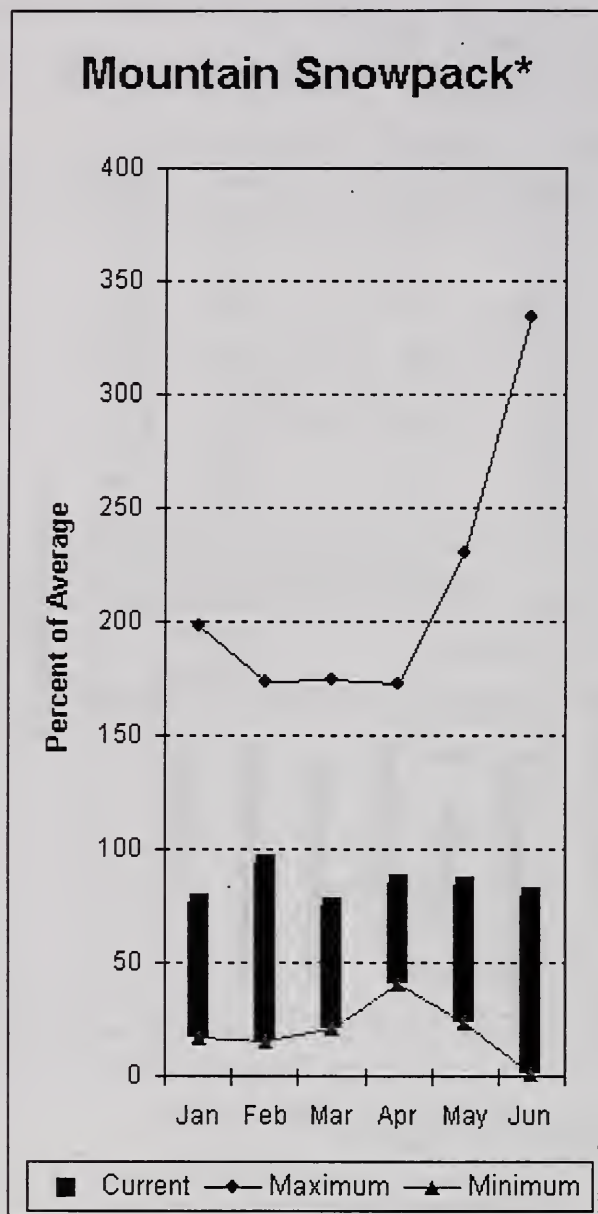
\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

(1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.

(2) - The value is natural volume - actual volume may be affected by upstream water management.

## Wenatchee - Chelan River Basins



\*Based on selected stations

Precipitation during May was 47% of average in the basin and 88% for the year-to-date. Runoff for Entiat River is forecast to be 91% of average for the summer. The June-September average forecast for Chelan River is 86%, Wenatchee River at Plain is 94%, Stehekin River is 87%, Icicle Creek near Leavenworth is 116% and Stemilt Creek is 68%. May average streamflows on the Chelan River were 81% and on the Wenatchee River 79%. June 1 snowpack in the Wenatchee River Basin was 78% of average; and the Chelan, 80%. Sites on the Entiat, Stemilt Creek, and Colockum Creek all reported no snow. Reservoir storage in Lake Chelan was 452,600-acre feet, 96% of June 1 average and 67% of capacity. Lyman Lake SNOTEL had the most snow water with 49.1 inches of water. This site would normally have 50.8 inches on June 1. Temperatures were 1-2 degrees below normal for May and 2-3 degrees above normal for the water year.

*For more information contact your local Natural Resources Conservation Service office.*



# Wenatchee - Chelan River Basins

## Streamflow Forecasts - June 1, 2003

		<<===== Drier ===== Future Conditions ===== Wetter =====>>						
Forecast Point	Forecast Period	=====		Chance Of Exceeding *		=====		30-Yr Avg. (1000AF)
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
=====								
CHELAN RIVER near Chelan	JUN-SEP	465	560	625	86	690	785	728
	JUN-JUL	370	455	510	87	565	650	589
STEHEKIN near STEHEKIN	JUN-SEP	355	420	465	87	510	575	535
	JUN-JUL	260	315	350	86	385	440	408
ENTIAT RIVER near Ardenvoir	JUN-JUL	89	105	115	91	125	141	127
	JUN-SEP	109	124	135	91	146	161	149
WENATCHEE at Plain	JUN-JUL	430	495	540	94	585	650	574
	JUN-SEP	510	595	650	94	705	790	694
STEMILT nr Wenatchee (miners in)	MAY-SEP	49	76	94	68	112	139	138
ICICLE CREEK near Leavenworth	JUN-SEP	190	215	230	116	245	270	199
	JUN-JUL	167	190	205	119	220	245	172
COLUMBIA R. bl Rock Island Dam (2)	JUN-SEP	33364	36720	39000	86	41280	44640	45171
	JUN-JUL	24064	27420	29700	86	31980	35340	34423

WENATCHEE - CHELAN RIVER BASINS Reservoir Storage (1000 AF) - End of May					WENATCHEE - CHELAN RIVER BASINS Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
CHELAN LAKE	676.1	452.6	373.8	473.0	CHELAN LAKE BASIN	4	51	80
					ENTIAT RIVER	1	0	0
					WENATCHEE RIVER	6	48	78
					SQUILCHUCK CREEK	0	0	0
					STEMILT CREEK	1	0	0
					COLOCKUM CREEK	1	0	0

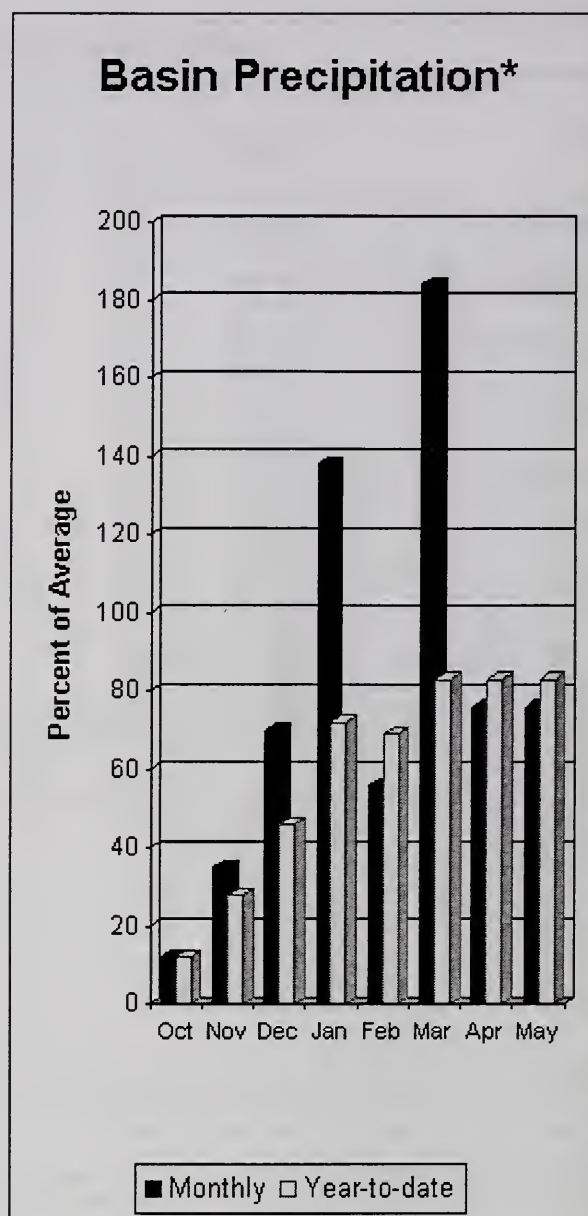
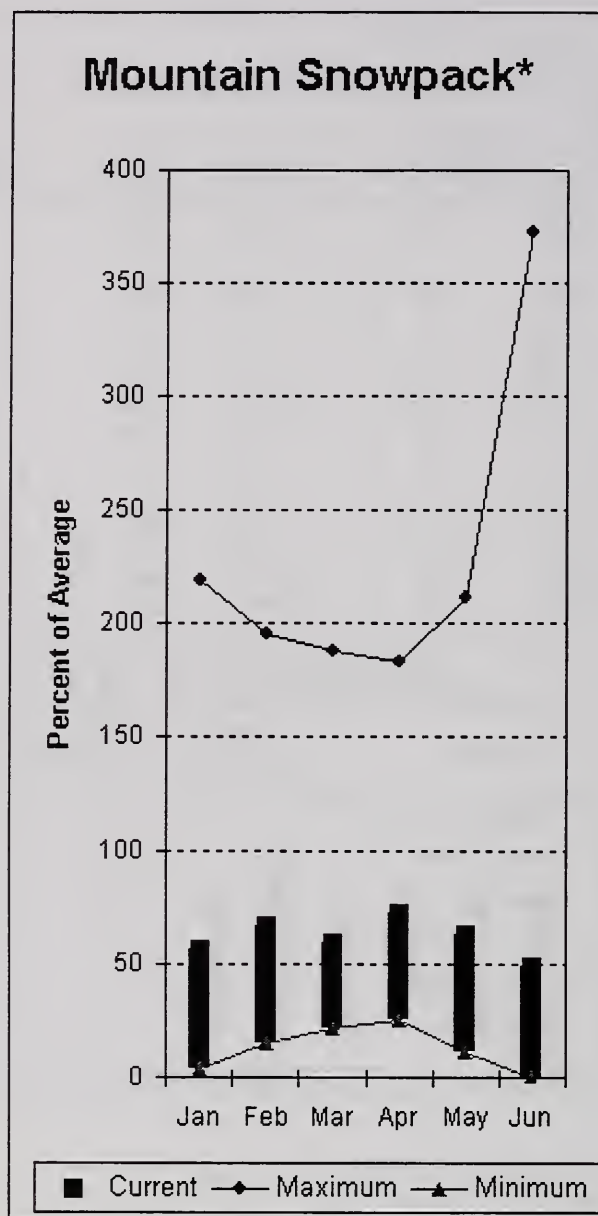
\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

(1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.

(2) - The value is natural volume - actual volume may be affected by upstream water management.

# Upper Yakima River Basin



\*Based on selected stations

June 1 reservoir storage for the Upper Yakima reservoirs was 733,700-acre feet, 101% of average. Forecasts for the Yakima River at Cle Elum are 100% of average and the Teanaway River near Cle Elum is at 68%. Lake inflows are all forecasted to near normal this summer. May streamflows within the basin were Yakima near Cle Elum at 72% and Cle Elum River near Roslyn at 77%. June 1 snowpack was 49% based upon 6 SNOTEL readings within the Upper Yakima Basin. Precipitation was 76% of average for May and 83% year-to-date for water. Volume forecasts for the Yakima Basin are for natural flow. As such, they June differ from the U.S. Bureau of Reclamation's forecast for the total water supply available, which includes irrigation return flow.

For more information contact your local Natural Resources Conservation Service office.



# Upper Yakima River Basin

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<<===== Drier =====		Future Conditions		===== Wetter =====>>		30-Yr Avg. (1000AF)
		Chance Of Exceeding *						
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
KEECHELUS LAKE INFLOW	JUN-JUL	35	44	50	106	56	65	47
	JUN-SEP	44	55	62	105	69	80	59
KACHESS LAKE INFLOW	JUN-JUL	27	34	39	91	44	51	43
	JUN-SEP	31	39	45	88	51	59	51
CLE ELUM LAKE INFLOW	JUN-JUL	145	169	186	97	205	225	192
	JUN-SEP	176	205	225	97	245	275	232
YAKIMA at Cle Elum	JUN-JUL	255	305	340	100	375	425	341
	JUN-SEP	320	380	420	100	460	520	421
TEANAWAY near Cle Elum	JUN-JUL	7.7	18.0	25	68	32	42	37
	JUN-SEP	10.1	20	27	68	34	44	40

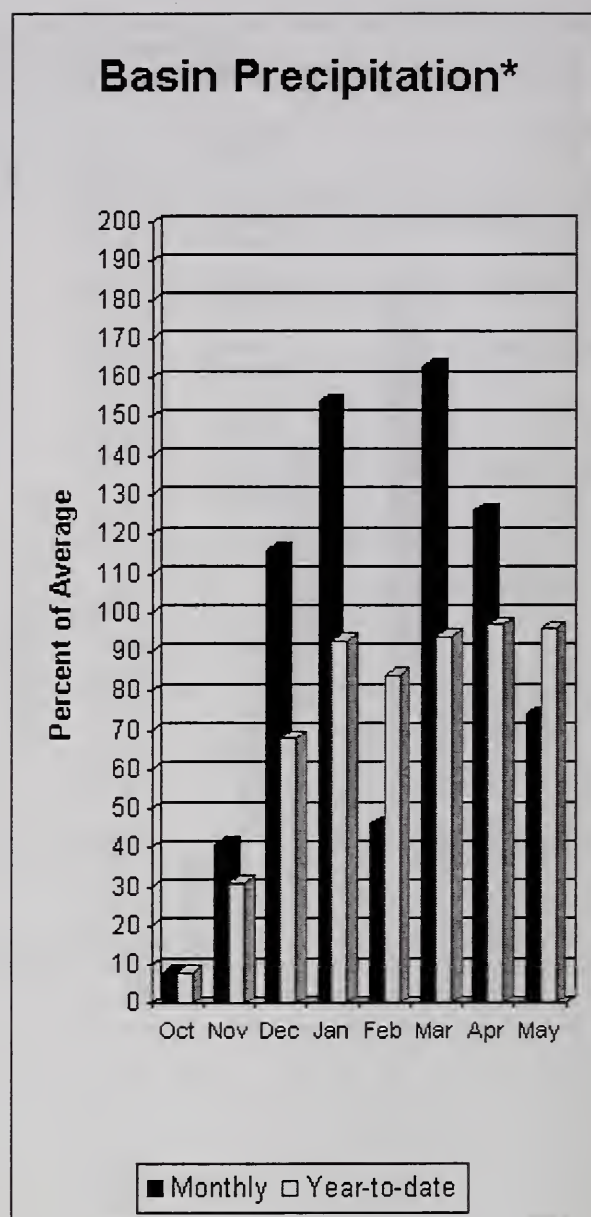
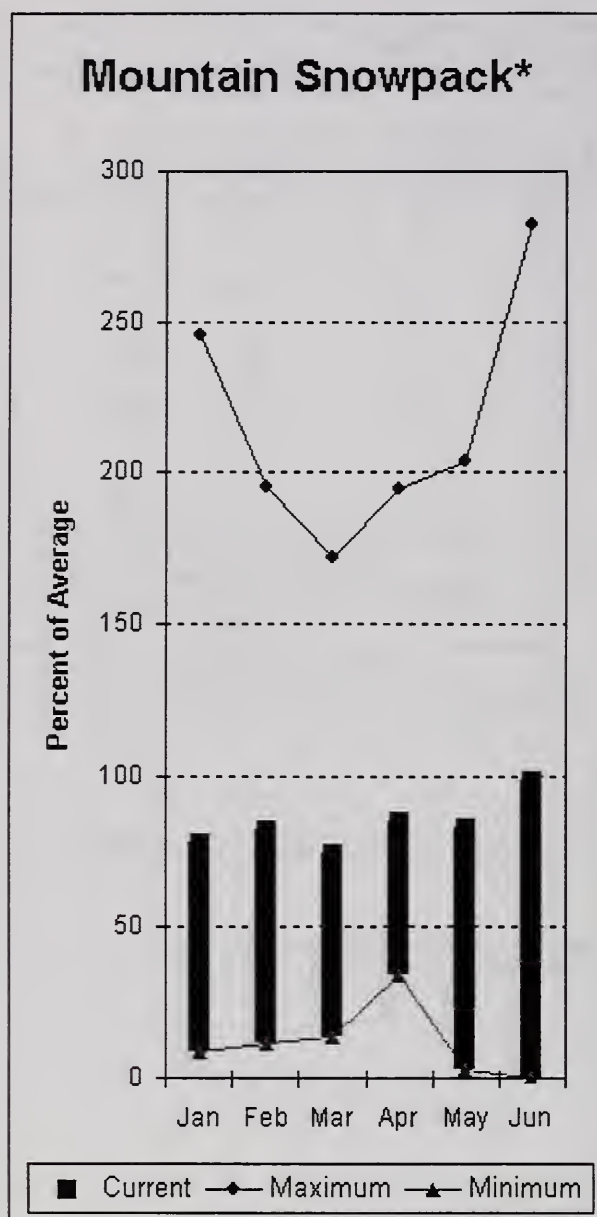
UPPER YAKIMA RIVER BASIN Reservoir Storage (1000 AF) - End of May					UPPER YAKIMA RIVER BASIN Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage *** This Year	Last Year	Avg	Watershed	Number of Data Sites	This Year as % of Last Yr	% of Average
KEECHELUS	157.8	86.6	137.3	140.5	UPPER YAKIMA RIVER	6	25	49
KACHESS	239.0	227.9	197.9	207.6				
CLE ELUM	436.9	419.2	407.0	379.3				

\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

- (1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.
- (2) - The value is natural volume - actual volume may be affected by upstream water management.

## Lower Yakima River Basin



\*Based on selected stations

May average streamflows within the basin were: Yakima River near Parker, 79%; Naches River near Naches, 84%; and Yakima River at Kiona, 67%. June 1 reservoir storage for Bumping and Rimrock reservoirs was 232,400-acre feet, 114% of average. Forecast averages for Yakima River near Parker are 98%; American River near Nile, 91%; Ahtanum Creek, 113%; and Klickitat River near Glenwood, 83%. June 1 snowpack was 98% based upon 5 SNOTEL readings within the Lower Yakima Basin and 93% of average in the Ahtanum Creek Basin. Precipitation was 74% of average for May and 96% year-to-date for water. Temperatures were 1 degree below normal for the month and 2 degrees above average for the water year. Volume forecasts for Yakima Basin are for natural flow. As such, they June differ from the U.S. Bureau of Reclamation's forecast for the total water supply available, which includes irrigation return flow.

*For more information contact your local Natural Resources Conservation Service office.*



# Lower Yakima River Basin

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<<===== Drier ===== Future Conditions ===== Wetter =====>>		Chance Of Exceeding *				30-Yr Avg. (1000AF)
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
BUMPING LAKE INFLOW	JUN-SEP	47	60	69	97	78	91	71
	JUN-JUL	39	51	59	97	67	79	61
AMERICAN RIVER near Nile	JUN-SEP	45	52	57	91	62	69	63
	JUN-JUL	37	44	49	91	54	61	54
RIMROCK LAKE INFLOW	JUN-SEP	112	126	136	94	146	160	144
	JUN-JUL	81	92	100	95	108	119	105
NACHES near Naches	JUN-SEP	305	360	400	98	440	495	410
	JUN-JUL	240	290	320	97	350	400	331
AHTANUM CREEK nr Tampico (2)	MAY-SEP	34	40	43	113	46	52	38
	MAY-JUL	30	35	38	112	41	46	34
YAKIMA near Parker	JUN-SEP	645	785	880	98	970	1110	901
	JUN-JUL	505	620	700	98	780	895	713
KLICKITAT near Glenwood	JUN-JUN	25	31	35	80	39	45	44
	JUN-SEP	48	58	65	83	72	82	78

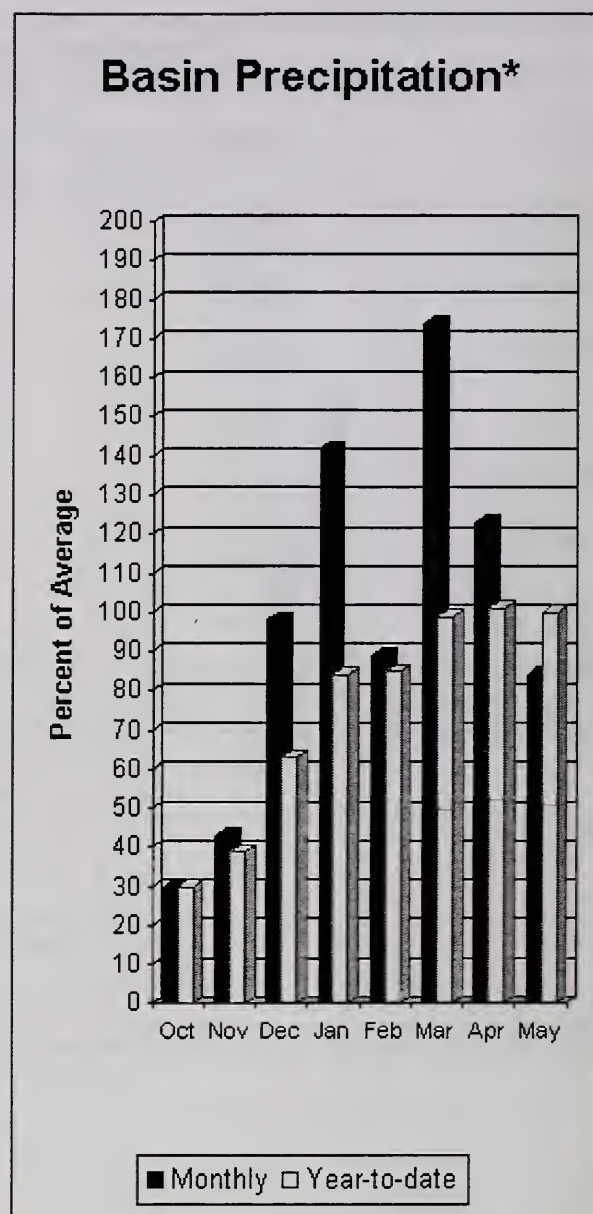
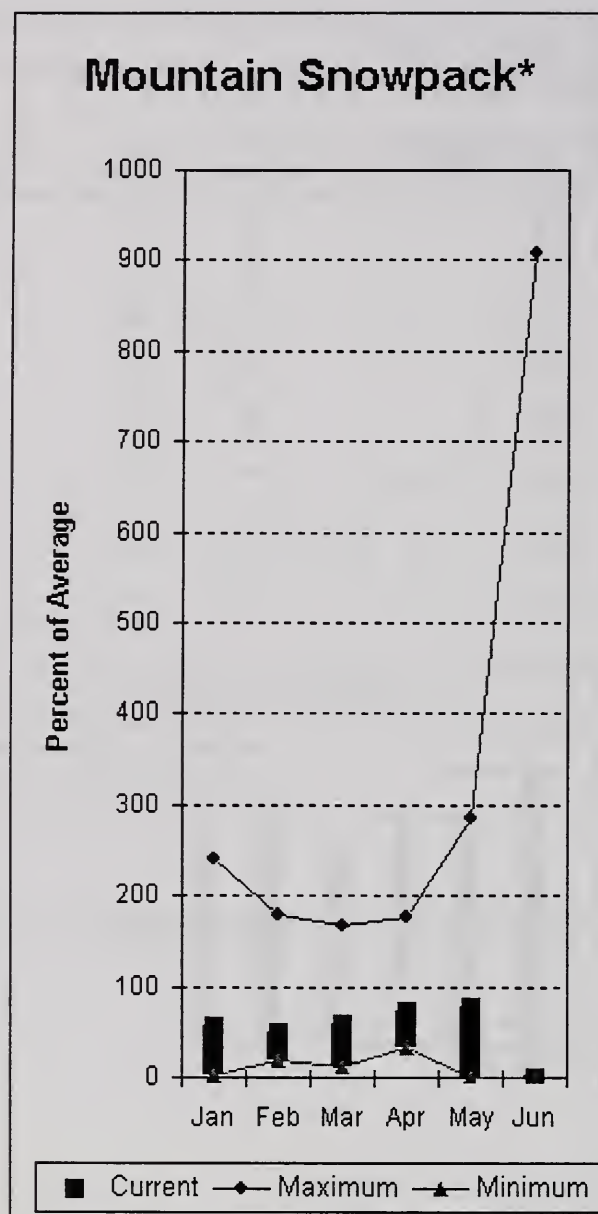
LOWER YAKIMA RIVER BASIN Reservoir Storage (1000 AF) - End of May					LOWER YAKIMA RIVER BASIN Watershed Snowpack Analysis - June 1, 2003		
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of Last Yr Average
		This Year	Last Year	Avg			
BUMPING LAKE	33.7	34.4	33.7	30.4			
RIMROCK	198.0	198.0	193.0	173.5			

\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

- (1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.  
 (2) - The value is natural volume - actual volume may be affected by upstream water management.

# Walla Walla River Basin



\*Based on selected stations

May precipitation was 84% of average, maintaining the year-to-date precipitation at 101% of average. Both SNOTEL sites in the basin melted out before the first of the month. Streamflow forecasts are 86% of average for Mill Creek and 84% for the SF Walla Walla near Milton-Freewater. May streamflow was 93% of average for the Walla Walla River. Average temperatures were 2 degrees below normal for May and near average for the water year.

*For more information contact your local Natural Resources Conservation Service office.*



# Walla Walla River Basin

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<===== Drier ===== Future Conditions ===== Wetter =====>						
		=====		Chance Of Exceeding *		=====		30-Yr Avg. (1000AF)
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
MILL CREEK at Walla Walla	MAY-SEP	2.70	4.60	5.90	66	7.20	9.10	9.00
	MAY-JUL	2.50	4.40	5.70	64	7.00	8.90	8.90
SF WALLA WALLA near Milton-Freewater	JUN-JUL	10.9	13.7	15.6	81	17.1	20	19.3
	JUN-SEP	21	24	27	84	30	33	32

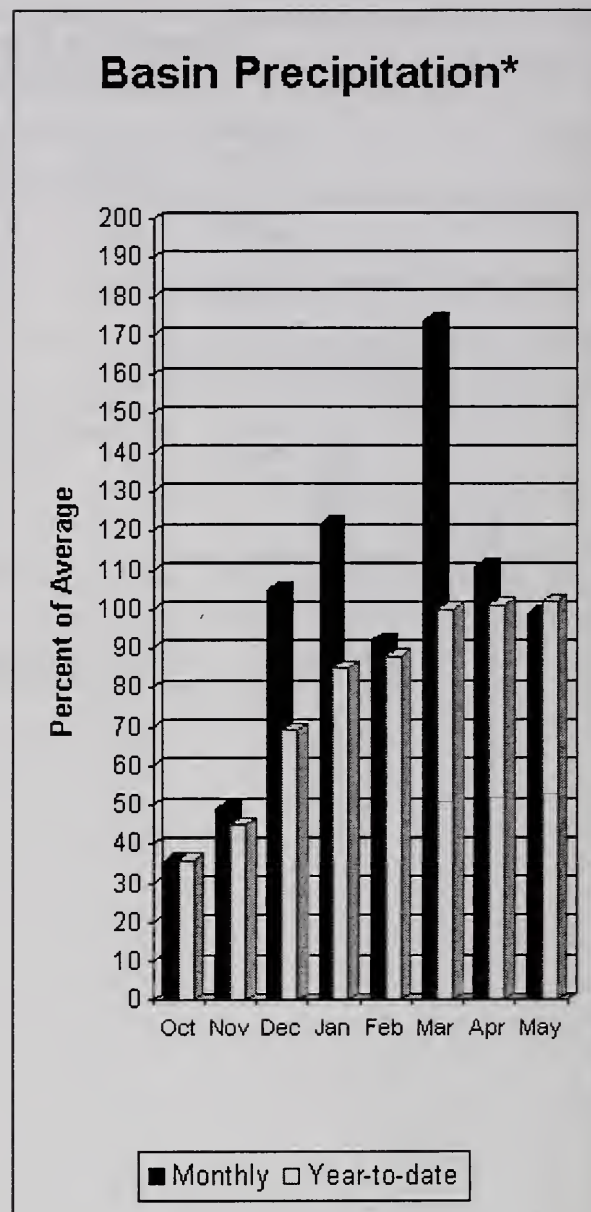
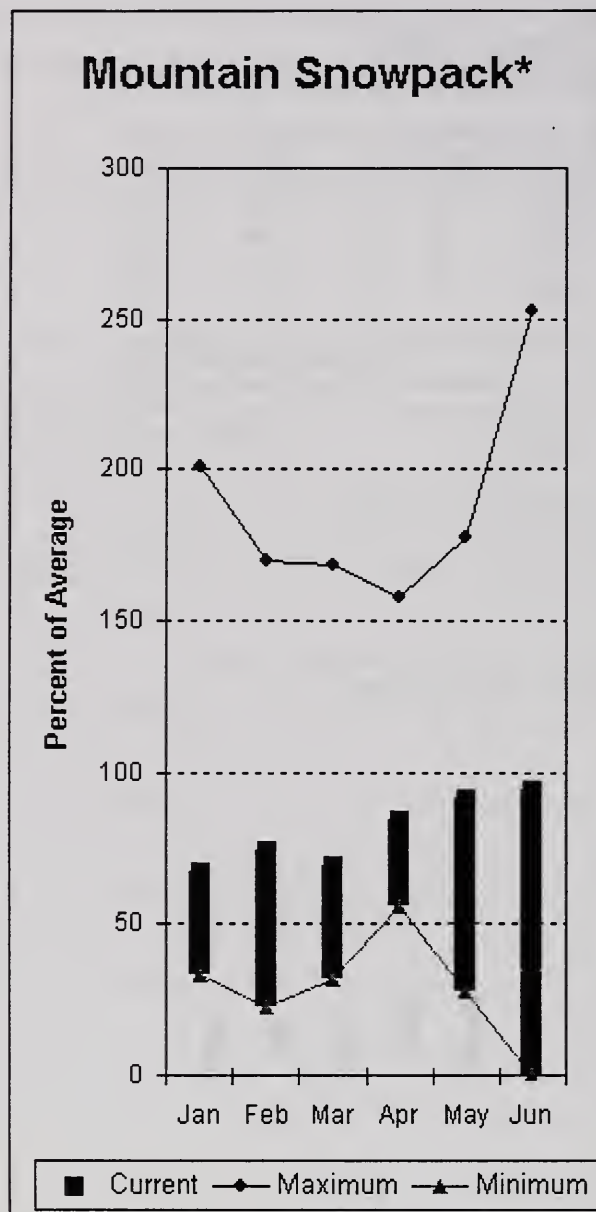
WALLA WALLA RIVER BASIN Reservoir Storage (1000 AF) - End of May					WALLA WALLA RIVER BASIN Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
					WALLA WALLA RIVER	2	0	0

\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

- (1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.
- (2) - The value is natural volume - actual volume may be affected by upstream water management.

## Lower Snake River Basin



\*Based on selected stations

The June - September forecast is for 113% for Clearwater River at Spalding. The Snake and Grande Ronde rivers can expect summer flows to be about 82% and 90% of normal respectively. May precipitation was 99% of average, bringing the year-to-date precipitation to 102% of average. June 1 snowpack readings averaged 94% of normal. May streamflow was 83% of average for Snake River below Lower Granite Dam and 83% for Grande Ronde River near Troy. Average temperatures were 1 degree below normal for May and near normal for the water year.

*For more information contact your local Natural Resources Conservation Service office.*



# Lower Snake River Basin

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<===== Drier ===== Future Conditions ===== Wetter =====>						30-Yr Avg. (1000AF)
		Chance Of Exceeding *						
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
GRANDE RONDE at Troy (1)	JUN-JUL	294	384	425	91	466	555	466
	JUN-SEP	353	461	510	90	559	667	564
CLEARWATER at Spalding (1,2)	JUN-JUL	2200	2990	3350	113	3710	4500	2959
	JUN-SEP	2560	3410	3800	113	4190	5040	3374
SNAKE blw Lower Granite Dam (1,2)	JUN-JUL	6453	7565	8070	83	8575	9690	9678
	JUN-SEP	8147	9559	10200	82	10840	12250	12390

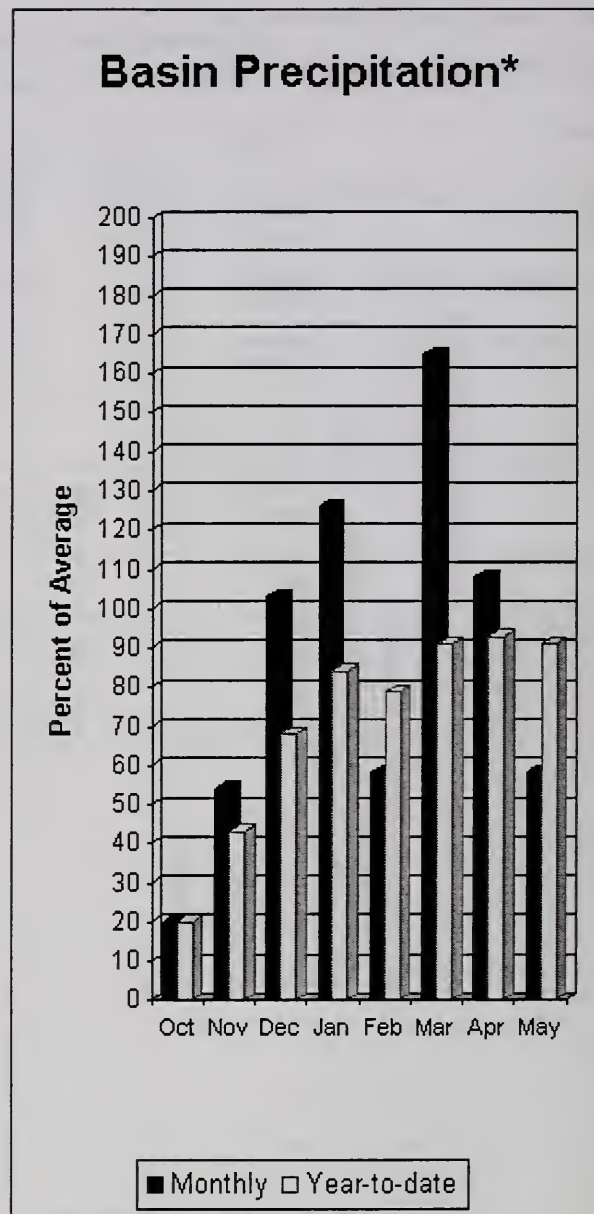
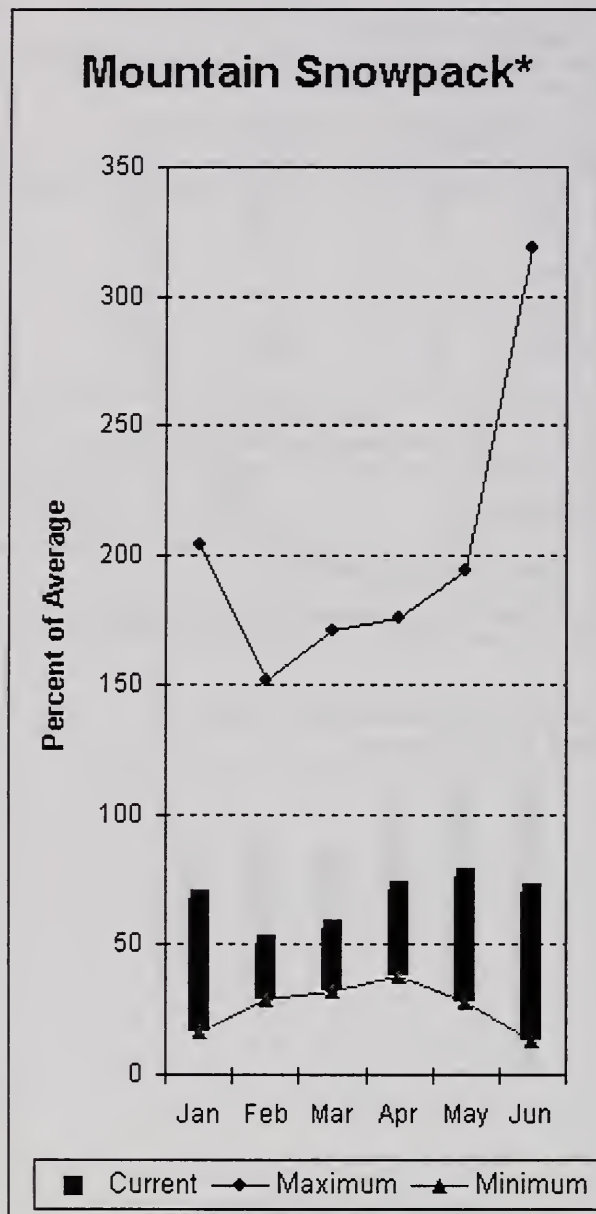
LOWER SNAKE RIVER BASIN Reservoir Storage (1000 AF) - End of May					LOWER SNAKE RIVER BASIN Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
					LOWER SNAKE, GRANDE RONDE	8	67	94

\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

- (1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.
- (2) - The value is natural volume - actual volume may be affected by upstream water management.

## Cowlitz - Lewis River Basins



\*Based on selected stations

Forecasts for June – September streamflows within the basin are Lewis River at Ariel, 85% and Cowlitz River at Castle Rock, 76% of average. May average streamflow for Cowlitz River was 70% and 72% for Lewis River. The Columbia River at The Dalles was 77% of average. May precipitation was 58% of average and the water-year average was 91%. June 1 snow cover for Cowlitz River was 76%, and Lewis River was 65% of average. Average temperatures were near normal during May and have averaged 1 degree above throughout the water year.

*For more information contact your local Natural Resources Conservation Service office.*



# Cowlitz - Lewis River Basins

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<===== Drier ===== Future Conditions ===== Wetter =====>						30-Yr Avg. (1000AF)
		Chance Of Exceeding *						
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
LEWIS at Ariel (2)	JUN-JUL	209	251	280	83	309	351	338
	JUN-SEP	324	375	410	85	445	496	483
COWLITZ R. bl Mayfield Dam (2)	JUN-SEP	9.0	424	740	79	1056	1520	938
COWLITZ R. at Castle Rock (2)	JUN-SEP	36	557	960	76	1363	1957	1259
KLICKITAT near Glenwood	JUN-JUN	25	31	35	80	39	45	44
	JUN-SEP	48	58	65	83	72	82	78
COLUMBIA R. at The Dalles (2)	JUN-SEP	36345	43166	47800	80	52430	59250	59652
	JUN-JUL	26544	32234	36100	80	39970	45660	45431

COWLITZ - LEWIS RIVER BASINS Reservoir Storage (1000 AF) - End of May					COWLITZ - LEWIS RIVER BASINS Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
					LEWIS RIVER	4	26	65
					COWLITZ RIVER	5	54	76

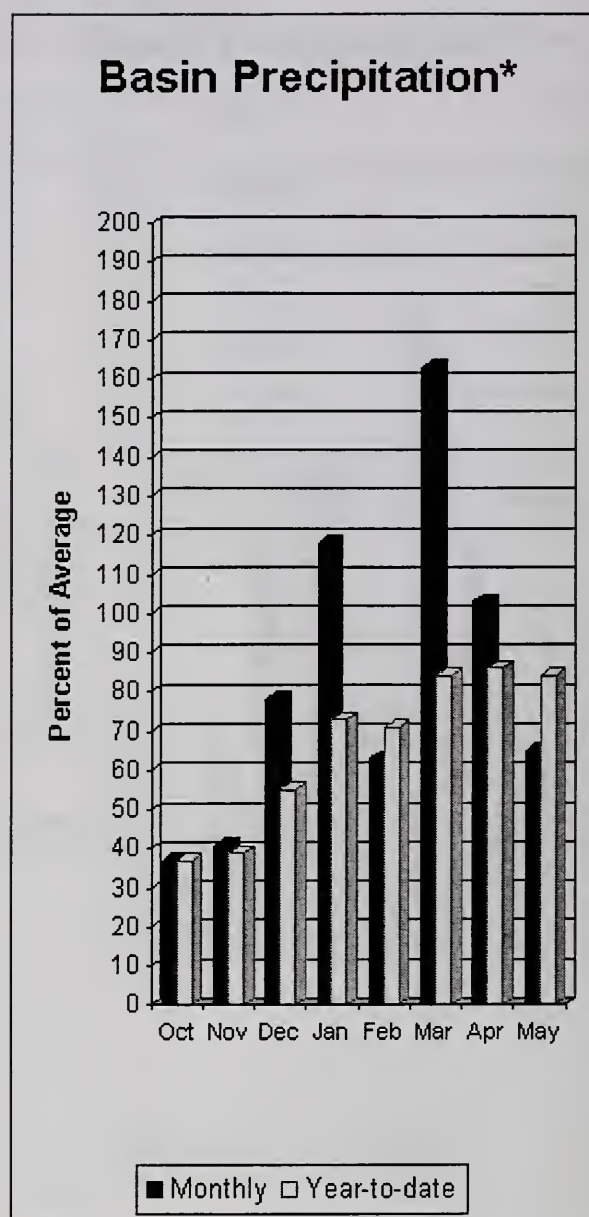
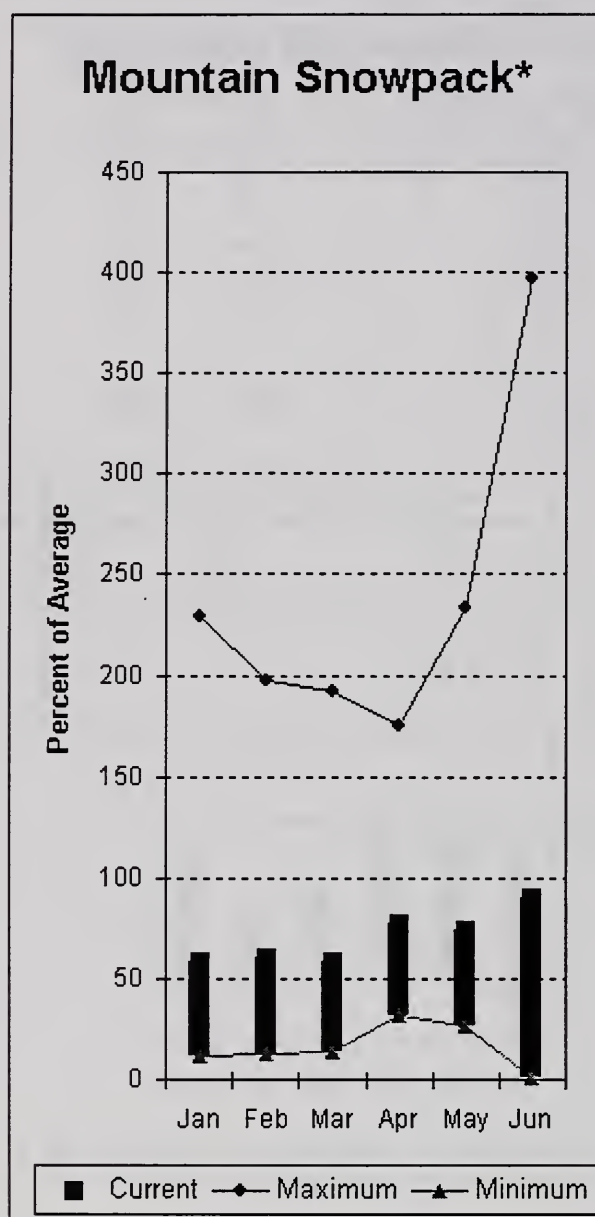
\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

(1) - The values listed under the 10% and 90% Chance of Exceeding are actually 5% and 95% exceedance levels.

(2) - The value is natural volume - actual volume may be affected by upstream water management.

## White - Green River Basins



\*Based on selected stations

Summer runoff is forecast to be 86% of normal for the Green River below Howard Hanson Dam and 88% for the White River near Buckley. June 1 snowpack was 120% of average in both White River and Puyallup River basins and 61% in Green River Basin. Water content on June 1 at Corral Pass SNOTEL, at an elevation of 6,000 feet, was 25.2 inches. This site has a June 1 average of 23.1 inches. May precipitation was 65% of average, bringing the water year-to-date to 84% of average for the basins. Average temperatures in the area were 1 degree below normal last month and near normal for the water-year.

*For more information contact your local Natural Resources Conservation Service office.*



# White - Green - Puyallup River Basins

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<<===== Drier ===== Future Conditions ===== Wetter =====>>						30-Yr Avg. (1000AF)
		=====		Chance Of Exceeding *		=====		
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
WHITE near Buckley (1,2)	JUN-JUL	141	175	190	86	205	239	220
	JUN-SEP	212	255	275	88	295	338	313
GREEN below Howard Hanson (1,2)	JUN-JUL	33	53	62	85	71	91	73
	JUN-SEP	52	75	85	86	96	119	99

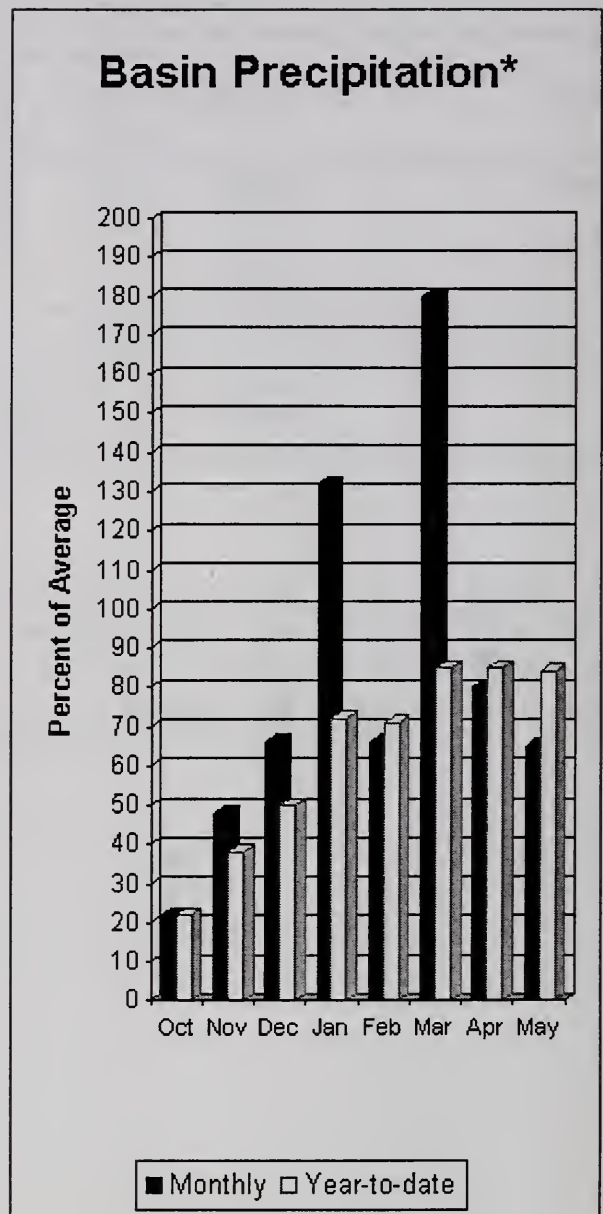
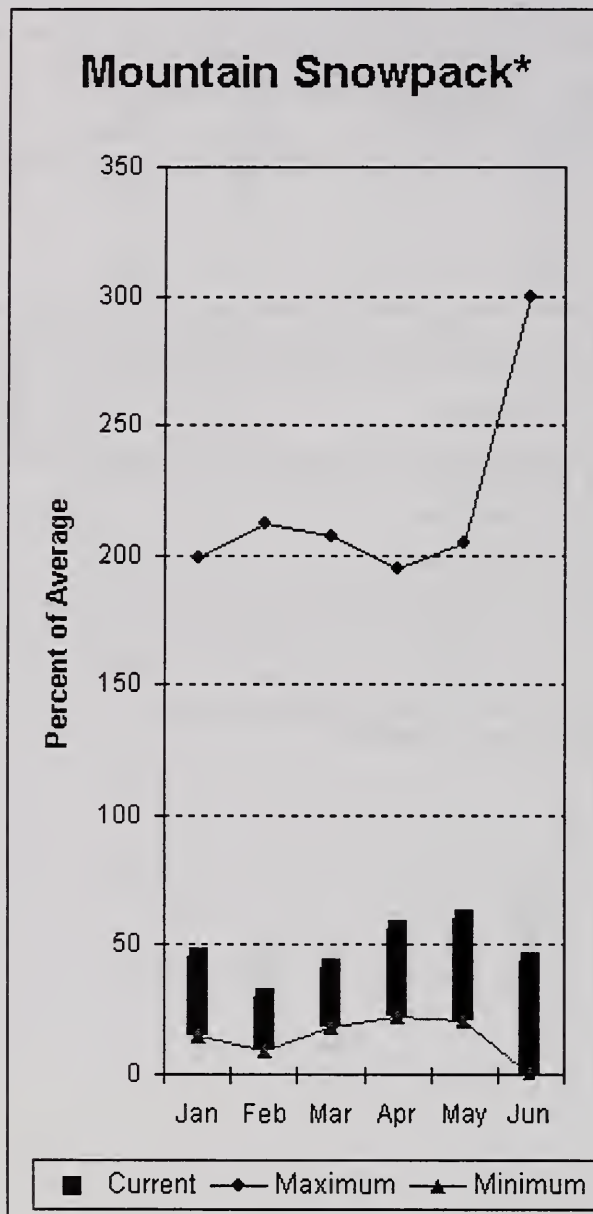
WHITE - GREEN - PUYALLUP RIVER BASINS Reservoir Storage (1000 AF) - End of May					WHITE - GREEN - PUYALLUP RIVER BASINS Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
					WHITE RIVER	2	98	120
					GREEN RIVER	2	10	61
					PUYALLUP RIVER	2	98	120

\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

The average is computed for the 1971-2000 base period.

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 (2) - The value is natural volume - actual volume may be affected by upstream water management.

## Central Puget Sound River Basins



\*Based on selected stations

Forecast for spring and summer flows are: 88% for Cedar River near Cedar Falls; 90% for Rex River; 94% for South Fork of the Tolt River; and 86% for Cedar River at Cedar Falls. Basin-wide precipitation for May was 65% of average, bringing water-year-to-date to 84% of average. June 1 snow cover in Cedar River Basin was all melted out. The Tolt River Basin was 39% of average; Snoqualmie River Basin was 53%, and Skykomish River Basin was 40%. Olallie Meadows SNOTEL site at 3960 feet, had 18.9 inches of water content. Average June 1 water content is 31.8 inches at Olallie Meadows. May temperatures were 1 degree below average for the past month and 1 degree above normal for the water-year.

*For more information contact your local Natural Resources Conservation Service office.*



# Central Puget Sound River Basins

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<<===== Drier ===== Future Conditions ===== Wetter =====>>						30-Yr Avg. (1000AF)
		Chance Of Exceeding *						
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
CEDAR near Cedar Falls	JUN-JUL	13.2	19.6	24	89	28	35	27
	JUN-SEP	16.8	25	30	88	35	43	34
REX near Cedar Falls	JUN-JUL	2.52	5.43	7.40	90	9.37	12.28	8.20
	JUN-SEP	3.7	7.3	9.7	90	12.1	15.7	10.8
CEDAR RIVER at Cedar Falls	JUN-JUL	7.1	11.8	15.0	82	18.2	23	18.2
	JUN-SEP	10.1	13.0	15.0	86	17.0	19.9	17.5
SOUTH FORK TOLT near Index	JUN-JUL	3.81	4.82	5.50	90	6.18	7.19	6.10
	JUN-SEP	5.99	7.07	7.80	94	8.53	9.61	8.30

CENTRAL PUGET SOUND RIVER BASINS Reservoir Storage (1000 AF) - End of May					CENTRAL PUGET SOUND RIVER BASINS Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
					CEDAR RIVER	4	0	0
					TOLT RIVER	2	17	39
					SNOQUALMIE RIVER	4	26	53
					SKYKOMISH RIVER	2	23	40

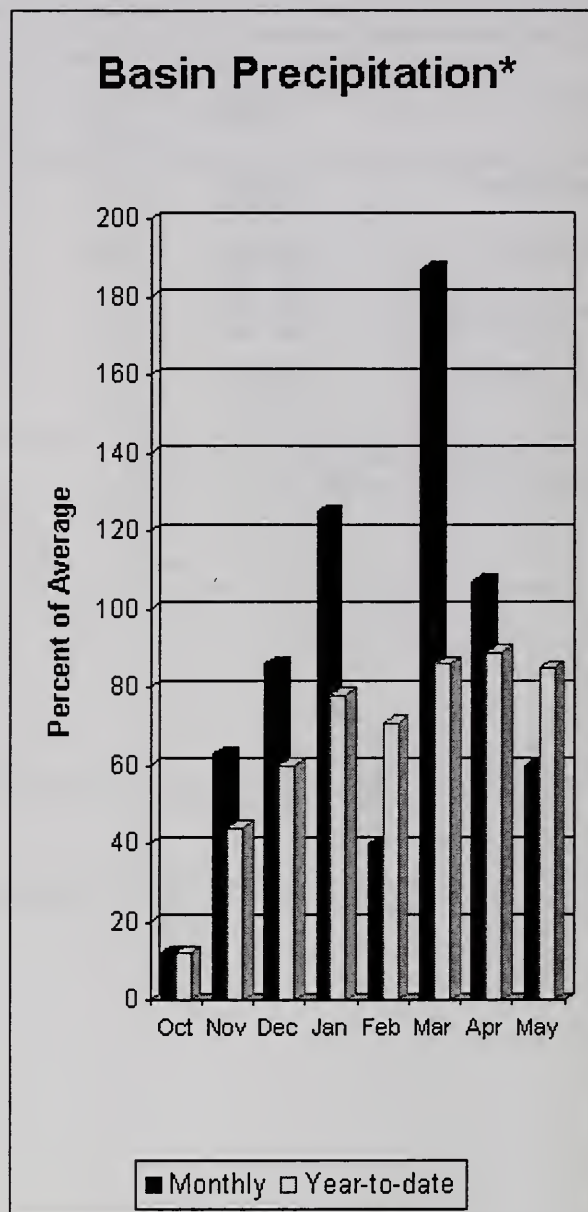
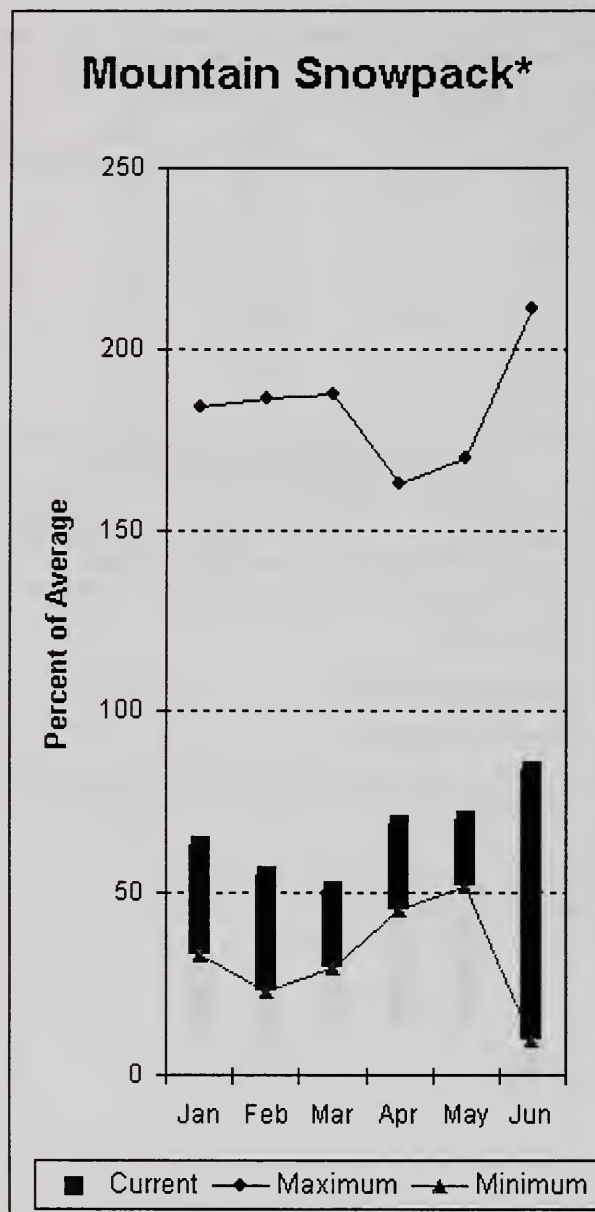
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## North Puget Sound River Basins



\*Based on selected stations

Forecast for Skagit River streamflow at Newhalem is 87% of average for the spring and summer period. May streamflow in Skagit River was 73% of average. Other forecast points included Baker River at 85% and Thunder Creek at 90% of average. Basin-wide precipitation for May was 60% of average, bringing water-year-to-date to 85% of average. June 1 average snow cover in Skagit River Basin was 87% and Baker River Basin was 80%. Rainy Pass SNOTEL, at 4,780 feet, had 19.6 inches of water content. Average June 1 water content is 24.3 inches at Rainy Pass. June 1 Skagit River reservoir storage was 115% of average and 85% of capacity. Average May temperatures were 1 degree below normal for the basin and 1 degree above average for the water year.

For more information contact your local Natural Resources Conservation Service office.

# North Puget Sound River Basins

## Streamflow Forecasts - June 1, 2003

Forecast Point	Forecast Period	<===== Drier ===== Future Conditions ===== Wetter =====>						30-Yr Avg. (1000AF)
		Chance Of Exceeding *						
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	
THUNDER CREEK near Newhalem	JUN-JUL	118	131	140	89	149	162	158
	JUN-SEP	201	218	230	90	242	259	257
SKAGIT at Newhalem (2)	JUN-JUL	757	851	915	87	979	1073	1054
	JUN-SEP	1043	1149	1220	87	1291	1397	1407
BAKER RIVER near Concrete	JUN-JUL	343	371	390	84	409	437	465
	JUN-SEP	558	574	585	85	596	612	687

NORTH PUGET SOUND RIVER BASINS Reservoir Storage (1000 AF) - End of May					NORTH PUGET SOUND RIVER BASINS Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
ROSS	1404.1	1188.8	834.5	1031.4	SKAGIT RIVER	2	57	87
DIABLO RESERVOIR		NO REPORT			BAKER RIVER	0	61	0
GORGE RESERVOIR		NO REPORT			NOOKSACK RIVER	1	10	0

\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

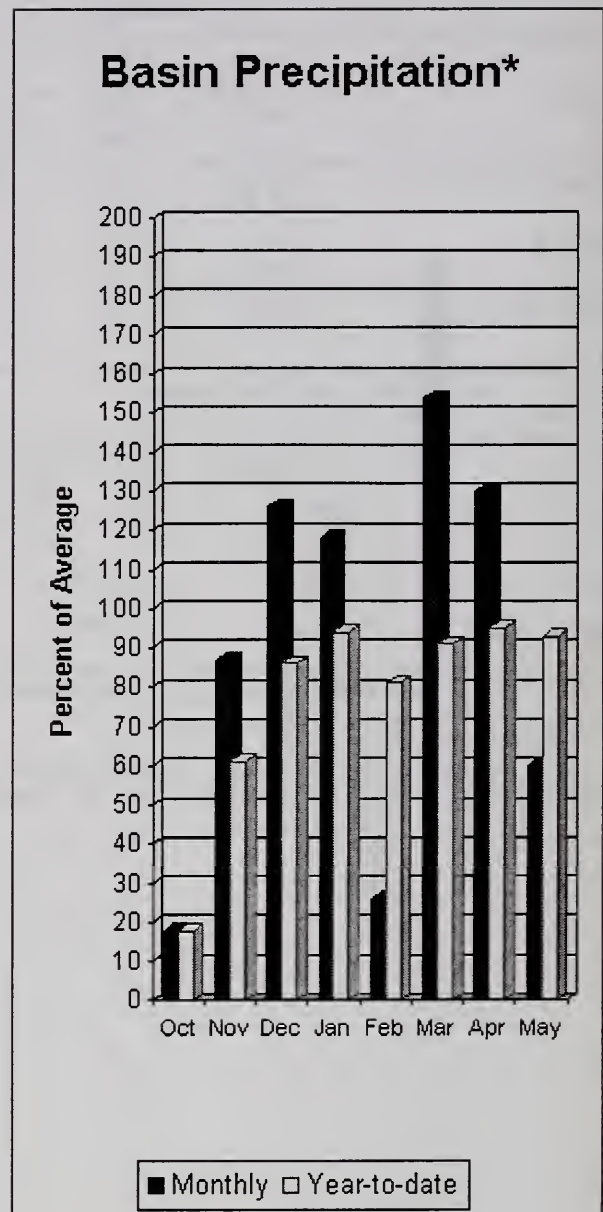
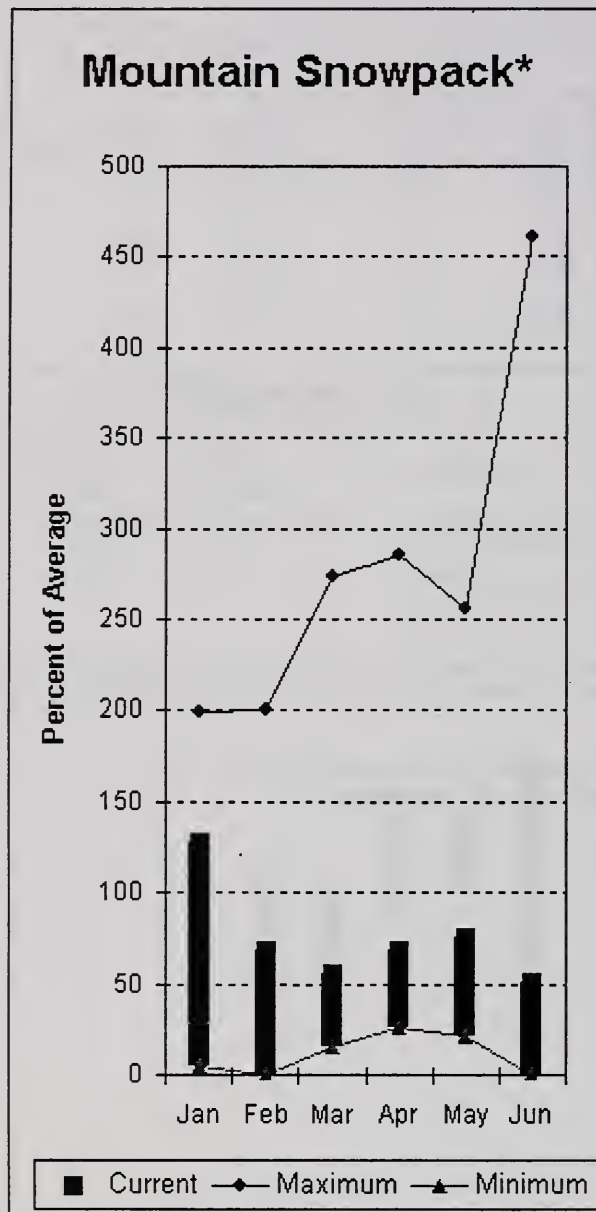
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# Olympic Peninsula River Basins



\*Based on selected stations

Forecasted average runoff for streamflow for both the Dungeness River and Elwha River basins is 87%. Big Quilcene River should expect slightly below average runoff this summer also. May precipitation was 60% of average. Precipitation has accumulated at 93% of average for the water year. May precipitation at Quillayute was one-half of normal at 0.57 inches. The thirty-year average for May is 1.09 inches. Mt. Crag SNOTEL, on the East slope, reported 51% of average snow water content on June 1. Temperatures were 1-2 degrees below average for the month and near normal for the water year.

*For more information contact your local Natural Resources Conservation Service office.*

# Olympic Peninsula River Basins

## Streamflow Forecasts - June 1, 2003

		<===== Drier ===== Future Conditions ===== Wetter =====>						
Forecast Point	Forecast Period	Chance Of Exceeding *		Chance Of Exceeding *		Chance Of Exceeding *		30-Yr Avg.
		90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	(% AVG.)	30% (1000AF)	10% (1000AF)	(1000AF)
DUNGENESS near Sequim	JUN-SEP	74	81	86	87	91	98	99
	JUN-JUL	53	58	61	86	64	69	71
ELWHA near Port Angeles	JUN-SEP	230	251	265	87	279	300	306
	JUN-JUL	168	184	195	88	206	222	222

OLYMPIC PENINSULA RIVER BASINS Reservoir Storage (1000 AF) - End of May					OLYMPIC PENINSULA RIVER BASINS Watershed Snowpack Analysis - June 1, 2003			
Reservoir	Usable Capacity	*** Usable Storage ***			Watershed	Number of Data Sites	This Year as % of	
		This Year	Last Year	Avg			Last Yr	Average
					OLYMPIC PENINSULA	1	20	51
					ELWHA RIVER	0	0	0
					MORSE CREEK	0	0	0
					DUNGENESS RIVER	0	0	0
					QUILCENE RIVER	1	20	51
					WYNOOCHEE RIVER	0	0	0

\* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual volume will exceed the volumes in the table.

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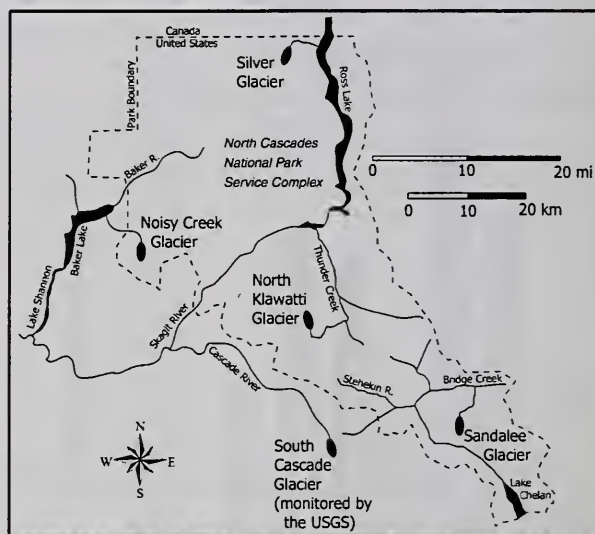


# GLACIER PAGE 2003

## North Cascades National Park Glacier Monitoring Program

The National Park Service began monitoring glaciers in North Cascades National Park in 1993 and Mount Rainier glaciers in 2002 (see the Mount Rainier Glacier Page). Goals for this program and additional data can be found at North Cascades National Park home page at <http://www.nps.gov/noca/massbalance.htm> or contact [Jon\\_Riedel@nps.gov](mailto:Jon_Riedel@nps.gov) or [Rob\\_Burrows@nps.gov](mailto:Rob_Burrows@nps.gov).

The four glaciers monitored are located at the headwaters of four watersheds, each with large hydroelectric operations (Figure 1). The glaciers represent a range in elevation from 8800 to 5600 feet, and a range in climatic conditions from maritime to continental. Methods include three visits annually to each glacier to measure winter accumulation and summer melt. Measurements are taken at a series of points down the centerline of each glacier (Table 1), then integrated across the entire glacier surface to determine mass balance for the entire glacier. Glaciers east of the hydrologic crest of the park (Silver and Sandalee) have recently had more positive mass balances than the west-side glaciers (Noisy, North Klawatti, South Cascade) due to their higher elevations, and north aspects (Figure 2). In addition to the accumulation



**Figure 1.** Glaciers monitored in North Cascades N.P.S. Complex.

Table 1.		Average	2003	2003
Glacier:	Elevation (feet)	Accumulation (inches W.E.)	Accumulation (inches W.E.)	Percent of Average
<b>Noisy Creek</b> Density= 0.50 @ 5900 ft 5/13/03	<b>Entire Glacier</b>	<b>129</b>	<b>119</b>	<b>93</b>
	6061	132	143	108
	6038	135	130	96
	5900	125	109	87
	5760	116	103	89
	5630	116	104	90
<b>Silver</b> Density= 0.41 @ 7544 ft 5/13/03	<b>Entire Glacier</b>	<b>97</b>	<b>73</b>	<b>76</b>
	8550	120	90*	75*
	8050	103	72	70
	7544	121	74*	61*
<b>N.Klawatti</b> Density= 0.47 @ 7700 0.51 @ 6080 5/19/03	<b>Entire Glacier</b>	<b>120</b>	<b>100</b>	<b>83</b>
	7665	125	103	83
	7300	127	104	82
	6900	127	103	81
	6390	109	91	84
	6080	99	88	88
<b>Sandalee</b> Density= 0.45 @ 7157 ft 5/15/03	<b>Entire Glacier</b>	<b>125</b>	<b>91</b>	<b>73</b>
	7360	117	86	73
	7157	131	88	67
	6900	118	88	75
	6780	139	97	70

and ablation measurements each glacier was remapped in 2002 to quantify terminus and surface elevation changes. A 10-year data summary will be published this year.

Table 1 presents this spring's provisional winter accumulation data, along with average values and percent of the 11-year average. The 2003 snow depths were measured between May 9 and 19 on the four glaciers. Ice layers and cold temperatures within the snowpack made probing difficult on the upper Silver Glacier. These data are extremely tentative (marked with \*) and will be revised after a July visit. We measured snow densities at the midpoint of three glaciers and at the top and bottom of N. Klawatti. Densities are in fraction of water density.

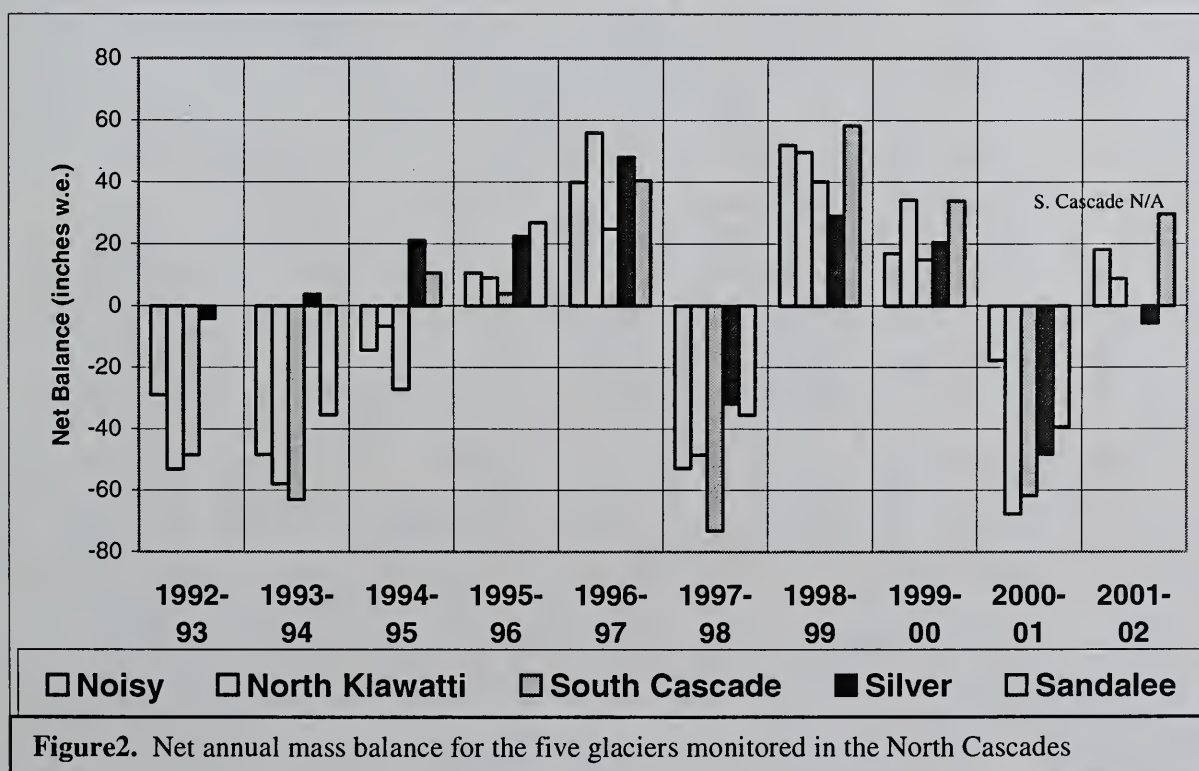


Estimates of glacial contribution to runoff for three watersheds are based on the mass balance measurements and GIS analyses to determine glacier area within 165 ft elevation bands (Table 2). Glaciers reduce the variation of flow in these watersheds by providing meltwater from ice in dry/warm years, and by storing water in wet/cool years. Glacial contribution to streamflow in these watersheds varies by as much as 100% annually. Magnitude of glacial contribution to streamflow is large, but varies by the amount of glacial cover in each watershed. Thunder Creek is 13% glacierized, while Baker River and Stehekin River are 6% and 3% glacierized, respectively (Post and others, 1971; Granshaw, 2002).

Relative importance of glacial contribution to streamflow increases from west to east. For example, glaciers annually contribute a higher percentage of meltwater to streamflow in the Stehekin watershed than in the Baker, despite the fact that the Baker is more glaciated. This is due to lower snowfall east of the hydrologic crest of the North Cascades. In this below average accumulation year we anticipate that glacier contribution to summer runoff will be above average, particularly because of below average snowpack at elevations below the glaciers.

	Mean Glacial Runoff	Range of Glacial Runoff		Percent Glacial Runoff to Total Summer Runoff	
		Minimum	Maximum	Minimum	Maximum
Noisy Creek Glacier	1.4	1.1	1.9	---	---
Baker River Watershed	66	48	94	5	12
North Klawatti Glacier	3.9	2.8	4.8	---	---
Thunder Creek Watershed	105	76	159	22	45
Sandalee Glacier	0.5	0.4	0.6	---	---
Stehekin River Watershed	70	50	106	6	16
Silver Glacier	0.9	0.7	1.0	---	---
Ross Lake Watershed	64	46	96	N/A	N/A

**Table 2.** Glacial contribution to summer stream flow (May 1 to Sept. 30) for three watersheds. Runoff units are thousands of acre-feet. Data from 1993-2002 except the Sandalee Glacier and Stehekin River Watershed (1995-2002).



# MOUNT RAINIER GLACIER PAGE 2003

This year the National Park Service continues to collect data and develop methods for monitoring mass balance annually on Mount Rainier glaciers. This program is a cooperative venture between Mount Rainier National Park, the US Geological Survey, and North Cascades National Park. The program includes field measurements on Nisqually Glacier and Emmons Glacier, annual air photography, and 10-year remapping of the glaciers below 10,000 feet.

Between April 1 and May 1 we measured bulk density of the snowpack, probed snow depths, and placed ablation stakes on the lower Nisqually (April 22 & 23) and Emmons (April 1, May 1) glaciers below 10,000 feet. Accumulation on the south side of the mountain (Muir Snowfield and Nisqually Glacier) shows an increasing trend with elevation to ~7400 feet and decreasing trend above (Table 1). A similar trend may exist on the Emmons this year but data gaps prevent definite conclusions. Maximum accumulation most likely occurred in mid/late May, later than the measurement dates. Nearby SNOTEL sites (Morse Lake, Corral Pass, and Paradise) indicate that snow water equivalent increased by 3-7 inches during this interim period, perhaps slightly more on the glaciers. Ablation stakes were placed at 7400 and 6150 feet on Nisqually Glacier, at 9920 and 9170 feet on the Muir Snowfield, and at 9450, 8990, 6360, and 5750 feet on Emmons Glacier. We will return in mid June to check ablation and place an additional stake near the terminus of each glacier. In addition we will probe snow depth higher on the mountain. On a fall visit (late September/early October) we will record final ablation measurements from the stakes. Last year over 23 feet (275 inches) water equivalent of surface melt occurred on the lower glaciers!

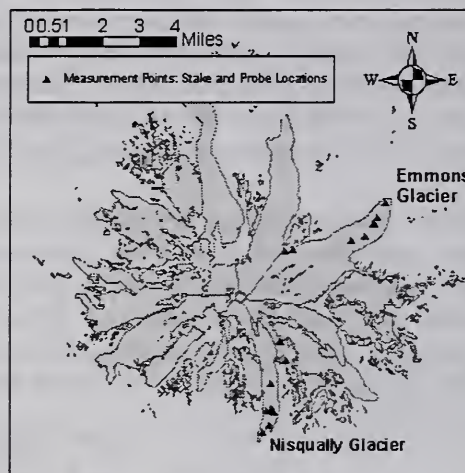


Figure 1. Glacier cover of Mount Rainier, monitored glaciers, and measurement locations on Muir Snowfield, Emmons, and Nisqually Glaciers

For more information contact Jon\_Riedel @nps.gov or Rob\_Burrows@nps.gov

Table 1	Elevation feet	Accumulation inches w.e.	Std Dev. inches w.e.	N
Emmons Glacier	9450	56	14	11
	8990	53	7	13
	6360	63	11	11
	6050	60	12	11
	5820	50	18	11
	5750	59	7	11
	5610	52	31	10
	5050	24	10	8
Muir Snowfield and Nisqually Glacier	9920	71	2	10
	9170	90	8	4
	7400	125	13	9
	6190	108	6	9
	6185	115	14	10
	6150	106	8	11
	6150	100	12	10
	5740	109	24	11
	5180	68	22	12
	5120	59	Paradise SNOTEL	

Table 1. Accumulation on Mount Rainier Glaciers, Spring 2003. Determined from probing snow depth on each elevation contour at "N" points. Standard deviation represents the variation in snow depths from changes in the underlying ice surface topography and wind drifting.

Table 2 Glacier	Snow Density	Altitude (ft)	Snow Depth (inches)	Date
Emmons	0.45	6360	63	4/1/03
Emmons	0.35	9450	56	5/1/03
Nisqually	0.46	7380	125	4/22/03

Table 2. Snow density was measured at three different points at three different times on Mt. Rainier this spring. Although the density was measured a month apart on the upper and lower Emmons Glacier we believe this represents the density at near maximum snow accumulation at each point.



*Issued by*

**Bruce Knight**  
**Chief**  
**Natural Resources Conservation Service**  
**U.S. Department of Agriculture**

*Released by*

**R.L. "Gus" Hugbanks**  
**State Conservationist**  
**Natural Resources Conservation Service**  
**Spokane, Washington**

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## The Following Organizations Cooperate with the Natural Resources Conservation Service in Snow Survey Work\*:

<b>Canada</b>	Ministry of Sustainable Resources Snow Survey, River Forecast Centre, Victoria, British Columbia
<b>State</b>	Washington State Department of Ecology Washington State Department of Natural Resources
<b>Federal</b>	Department of the Army Corps of Engineers U.S. Department of Agriculture Forest Service U.S. Department of Commerce NOAA, National Weather Service U.S. Department of Interior Bonneville Power Administration Bureau of Reclamation Geological Survey National Park Service Bureau of Indian Affairs
<b>Local</b>	City of Tacoma City of Seattle Chelan County P.U.D. Pacific Power and Light Company Puget Sound Power and Light Company Washington Water Power Company Snohomish County P.U.D. Colville Confederated Tribes Spokane County Yakama Indian Nation Whatcom County Pierce County
<b>Private</b>	Okanogan Irrigation District Wenatchee Heights Irrigation District Newman Lake Homeowners Association Whitestone Reclamation District

\*Other organizations and individuals furnish valuable information for the snow survey reports. Their cooperation is gratefully acknowledged.





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# Washington Water Supply Outlook Report

Natural Resources Conservation Service  
Spokane, WA

